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HELICOPTER DOWNWASH DATA

Grady W. Leese, et al

Army Engineer Waterways Experiment  
Station  
Vicksburg, Mississippi

June 1974

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# HELICOPTER DOWNWASH DATA

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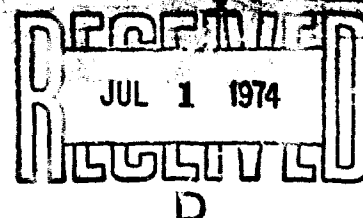
G. V. Leese, I. T. Knight, Jr.



June 1974

Sponsored by U. S. Army Materiel Command

Conducted by U. S. Army Engineer Waterways Experiment Station  
Soils and Pavements Laboratory  
Vicksburg, Mississippi



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This data report describes an investigation involving measurement of horizontal velocities, along and up to 6 ft above the ground surface, generated by the rotor systems of various Army helicopters during takeoff, hover, and fly-by operations. Measurements of ground-wash velocities during various operational modes were collected for OH-58A, OH-6A, AH-1G, UH-1H, UH-1M, CH-47, and CH-54 helicopters. These data are presented for record only with analyses being beyond the scope of this report.			

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## FOREWORD

The general authorization for this investigation is contained in Research and Development Project 1T062013A046 (Task 05), "Traffic-ability and Mobility Research." The investigation was performed under sponsorship of the Research, Development and Engineering Directorate, U. S. Army Materiel Command. Also participating in the investigation by making arrangements for and scheduling of aircraft and operating personnel was the U. S. Army Aeromedical Research Laboratory (ARL), Ft. Rucker, Ala.

The data reported herein were obtained during September and October 1971 by personnel of the U. S. Army Engineer Waterways Experiment Station (WES) Soils and Pavements Laboratory under the general supervision of Messrs. J. P. Sale and W. L. McInnis, and under the direct supervision of Mr. G. W. Leese. Personnel of the ARL assisting WES were under the command of COL R. W. Bailey and under the direct supervision of COL W. P. Shane and CPT G. R. McCahan, Jr. This report was prepared by Messrs. G. W. Leese and J. T. Knight, Jr.

Special acknowledgment is made to the U. S. Army Aviation Test Board of Ft. Rucker, Ala., for supplying the aircraft and operating personnel needed during this investigation.

Directors of WES during the conduct of this investigation and the preparation and publication of this report were BG E. D. Peixotto, CE, and COL G. H. Hilt, CE. Technical Director was Mr. F. R. Brown.

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# CONVERSION FACTORS, BRITISH TO METRIC UNITS OF MEASUREMENT

British units of measurement used in this report can be converted to metric units as follows:

<u>Multiply</u>	<u>By</u>	<u>To Obtain</u>
inches	2.54	centimeters
feet	0.3048	meters
square feet	0.092903	square meters
pounds (mass)	0.4535924	kilograms
pounds (force)	4.448222	newtons
pounds (mass) per square foot	4.882428	kilograms per square meter
pounds (force) per square foot	47.88026	newtons per square meter
miles per hour (U. S. statute)	1.609344	kilometers per hour



## SUMMARY

This data report describes an investigation involving measurement of horizontal velocities, along and up to 6 ft above the ground surface, generated by the rotor systems of various Army helicopters during take-off, hover, and fly-by operations.

Measurements of ground-wash velocities during various operational modes were collected for OH-58A, OH-6A, AH-1G, UH-1H, UH-1M, CH-47, and CH-54 helicopters.

These data are presented for record only with analyses being beyond the scope of this report.

## HELICOPTER DOWNWASH DATA

### PART I: INTRODUCTION

#### Background

1. The gradual increase in size and load-carrying capacity of the helicopter has created a need for predicting the effect of the rotor downwash on the ground surface, supporting equipment, cargo containers, operating personnel, and expedient surfacing materials. To fully define the ground-wash flow field, velocity measurements are needed under helicopters of various sizes and gross weights. From these flow-field characteristics, design parameters can be established to provide landing and takeoff operational areas for helicopters and to assist in predicting the flow-field characteristics of the larger and heavier helicopters of the future.

#### Purpose

2. The purpose of this investigation was to measure rotor downwash horizontal velocities along and up to 6 ft\* above the ground surface generated by various Army helicopters during takeoff, hover, and fly-by operations.

#### Scope

3. Tests were conducted at Ft. Rucker, Ala., with the CH-54 helicopter and at Apalachicola, Fla., utilizing various other Army helicopters operating over an array of instrumentation arranged in such a manner as to obtain ground-wash flow-field velocities produced by the

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\* A table of factors for converting British units of measurement to metric units is presented on page vii.

aircraft rotor systems during various modes of operation. Tabulations of the data obtained were made for each velocity measuring station. Analysis of the data was beyond the scope of this investigation.

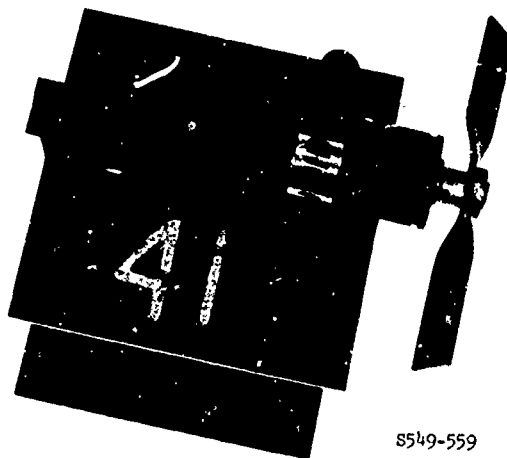
## PART II: INSTRUMENTATION AND AIRCRAFT

### Instrumentation

4. The instrumentation array consisted of a number of wind-velocity pickups placed along and above a gage line so as to sense the ground-wash velocities along and up to 6 ft above the ground surface that were generated by the helicopter's rotor system.

#### Velocity sensors

5. The wind-velocity sensors were fabricated at the U. S. Army Engineer Waterways Experiment Station (WES) by fitting small induction generators with 4-in.-diam propellers (fig. 1) and exciting the generators with 26-volt, 400-Hz current. The output of the generators was



S549-559

Fig. 1. Velocity sensor

proportional to their rpm's; and by passing this output through a rectifying bridge, it could be recorded using an oscillograph.

6. Tests in the WES Surface Blast Effects Research facility wind tunnel proved the velocity sensors and their electrical circuitry to be accurate and reliable. Calibration curves were established for each sensor before the field tests; wind tunnel tests after the field tests indicated satisfactory performance and accuracy of the sensors.

### Instrumented test areas

7. The test area at Apalachicola consisted of a concrete-surfaced aircraft parking area; the test area at Pt. Rucker was on a section of runway. Test procedures and instrumentation layout were the same at both locations. Velocity sensors were placed on the ground surface along a straight line; horizontal spacing between the sensors was 10 ft as shown in fig. 2.

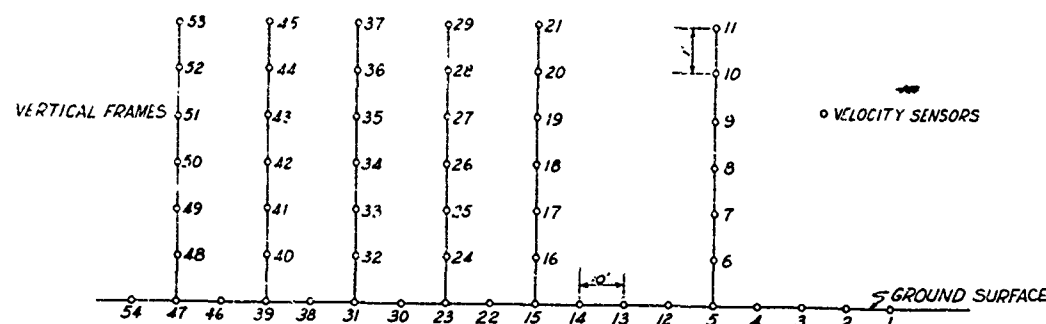


Fig. 2. Layout of velocity sensors

Along this same line, sensors were also mounted on vertical frames to obtain horizontal ground-wash velocities at 1-ft vertical intervals up to a height of 6 ft above the ground surface. Fig. 3 shows a close-up of the velocity sensors, and fig. 4 shows a complete vertical array. Fig. 5 is a ground view of the test site at Apalachicola, while fig. 6 is an aerial view of the same test area.

### Aircraft

8. The helicopters utilized in this study were the OH-58A, OH-6A, AH-1G, UH-1H, UH-1M, CH-47, and CH-54. Pertinent aircraft data are given in the following tabulation:

Heli- copter Type	Rotor		Disc		Weight, lb	
	No.	Diam ft	Area sq ft	Maximum Load, psf	Basic	Maximum Tested
OH-58A	1	35.33	980	3.26	1,740	3,200
OH-6A	1	26.3	543	3.31	1,163	1,800
AH-1G	1	44	1520	6.25	5,676	9,500
UH-1H	1	48.1	1817	5.22	4,717	9,500
UH-1M	1	44.3	1541	6.16	5,080	9,500
CH-47	2	59.1	5486	6.56	18,023	36,000
CH-54	1	72	4071	11.54	19,825	47,000

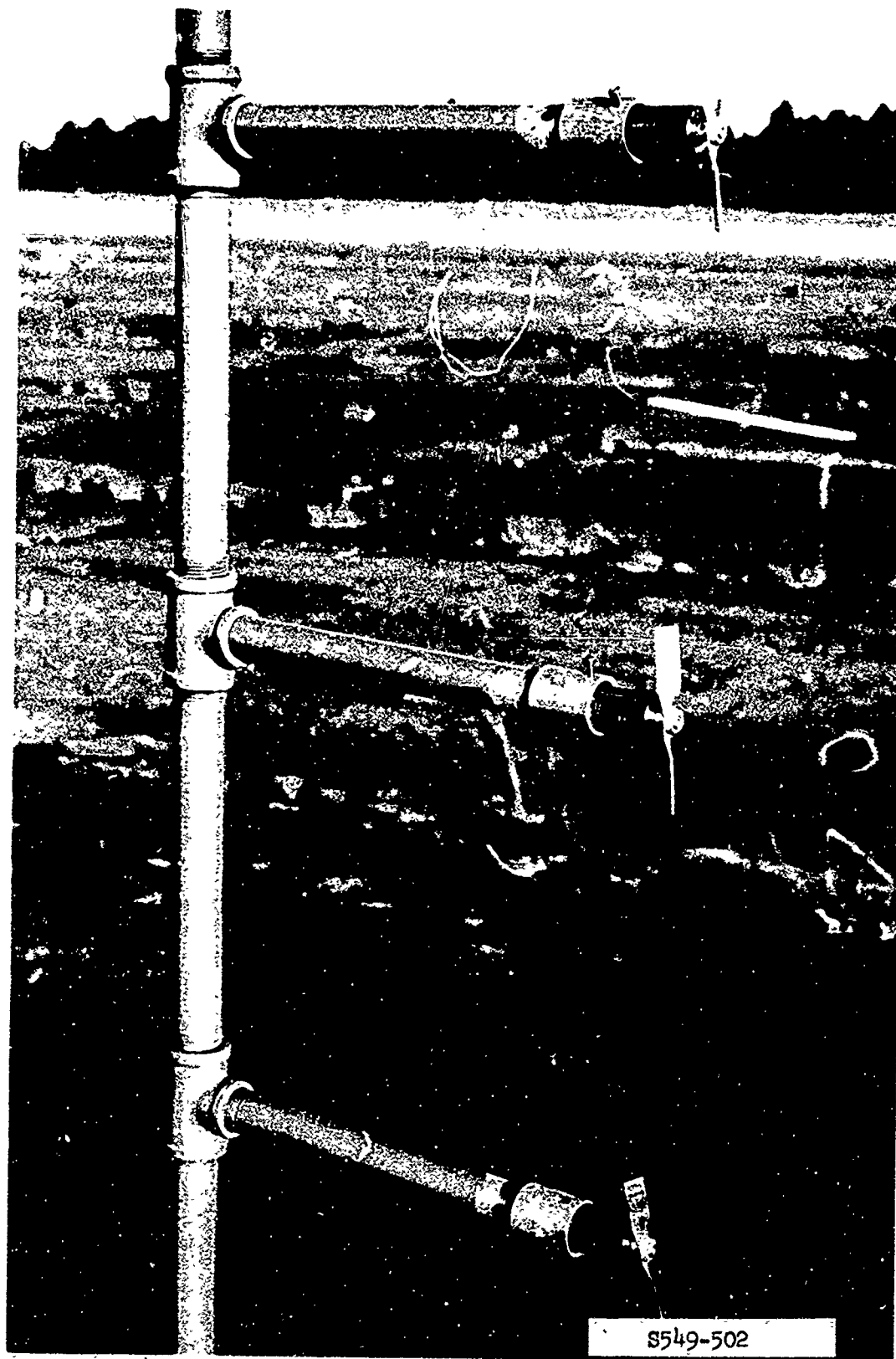


Fig. 3 Close-up of velocity sensors



Fig. 4 Single vertical array of velocity sensors

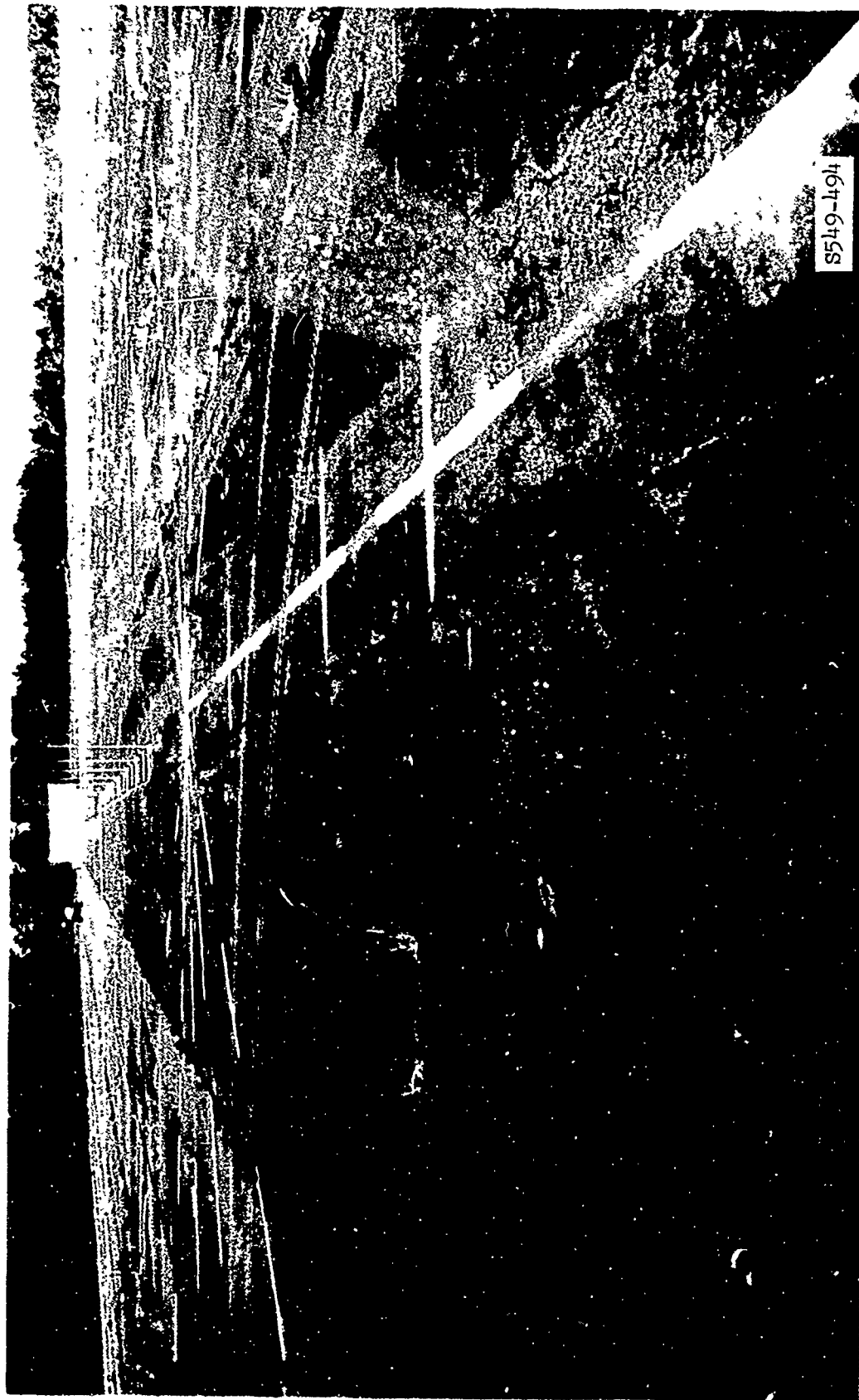


Fig. 5 Ground view of test site at Apalachicola



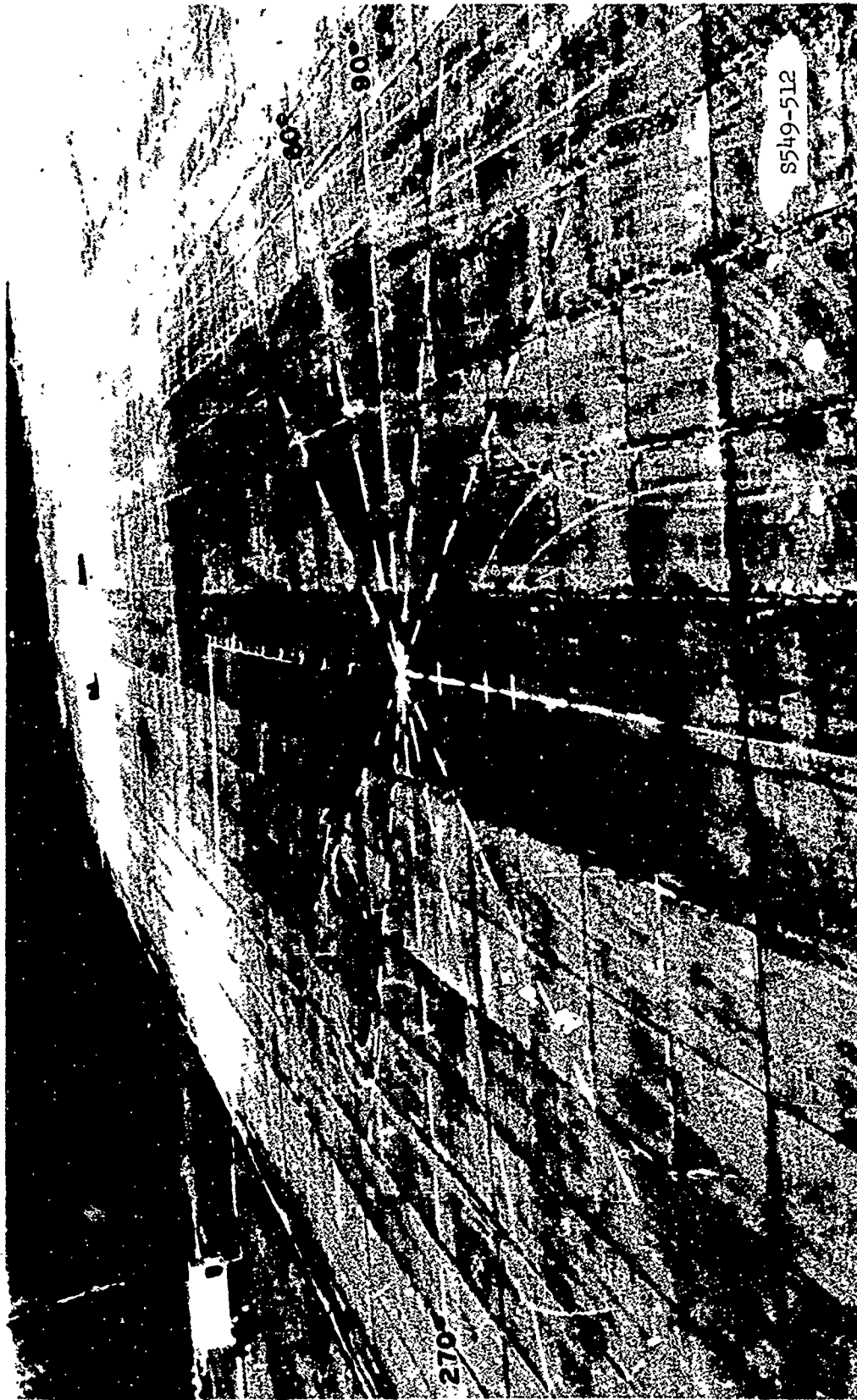


Fig. 6 Aerial view of Apalachicola test site

## PART III: TESTS AND DATA

### Test Procedure

9. The test plan was to measure the ground-wash horizontal velocities produced by as many different aircraft as could be made available. In order to obtain complete velocity ground-wash flow patterns, the sensors were monitored as the aircraft maintained a constant elevation above a point along the sensor line while the aircraft rotated about the rotor hub. Data were recorded for 30-deg increments of aircraft rotation where possible. Aircraft heading is referenced to the gage line with 0 deg being where the nose of the aircraft was pointing down the gage line; rotation was to the pilot's right (clockwise). The heights of the aircraft are referenced to the rotor actuator plane, hereafter referred to as the rotor.

### Data

#### OH-58A helicopter

10. Lift-off tests. Tests were made with the OH-58A during simulated lift-offs. To accomplish this the aircraft was flown with the landing gear just clear of the ground so as to ensure total weight on the rotor. This procedure was used to reduce both aircraft flight time and pilot fatigue. Velocity data were recorded at each 30-deg rotation of the aircraft. These data are shown in table 1.

11. Hover tests. Tests were also run with the OH-58A hovering over a point on the gage line at a height of 35 ft above the ground surface. Data recordings were made as the aircraft rotated in 90-deg increments. These data are shown in table 2. The aircraft was also hovered over the given point at a height of 13 ft above the surface with data recordings being made at each 30 deg of aircraft rotation. Data for these tests are also shown in table 2.

12. Fly-by tests. Tests were also made with the OH-58A flying over a given point and perpendicular to the gage line with two passes

being made at heights of 16 and 21 ft; one pass was made at each height on a 90-deg heading (gage line to pilot's left) and one pass at each height on a 270-deg heading (gage line to pilot's right). The data obtained are shown in table 3.

#### OH-6A helicopter

13. Lift-off tests. Tests were made with the OH-6A during simulated lift-offs, and data were recorded at helicopter rotations of 30-deg increments. These data are shown in table 4.

14. Hover tests. Tests were conducted with the helicopter hovering 34 ft above a given point on the gage line. Data were recorded at each 90-deg increment of rotation. No appreciable velocity was recorded at this test condition as can be seen in table 5.

15. Fly-by tests. Tests were conducted as the OH-6A flew over a given point on the gage line and perpendicular to it at a rotor height of 14 ft above the surface. Velocity sensors indicated area coverage of downwash was relatively small as can be seen in table 6.

#### AH-1G helicopter

16. Lift-off tests. Tests were made with the AH-1G positioned with the rotor hub over a given point on the gage line. Recordings of ground-wash velocities were made as the skids cleared the pavement. These data are shown in table 7.

17. Hover tests. Tests with the AH-1G hovering over a given point on the gage line were made with the rotor 44 ft above the ground surface. As the aircraft rotated over this point, data were recorded for various headings as shown in table 8.

18. Fly-by tests. In the fly-by tests data were recorded as the helicopter flew slowly over the specified point on the gage line at a rotor height of 22 ft. These data are shown in table 9.

#### UH-1H helicopter

19. Lift-off tests. Tests were made with the UH-1H positioned on a given point on the gage line. Recordings of the ground-wash velocities were made just as the aircraft cleared the pavement, duplicating lift-off conditions. These data are shown in table 10.

20. Hover tests. No hover tests were conducted with the UH-1H

as its flying time available for these tests was limited because of its special flight mission assignment.

21. Fly-by tests. Data for the fly-by tests were obtained as the UH-1H flew over a given point on the gage line at a rotor height of 20 ft above the ground surface. These data are shown in table 11.

UH-1M helicopter

22. Lift-off tests. Tests were made with the UH-1M by placing its rotor hub over a given point on the gage line and recording velocity data as the aircraft's skids cleared the paved surface, duplicating lift-off. The aircraft rotated in 30-deg increments, repeating the lift-off operation until full rotation was achieved. Data obtained are shown in table 12.

23. Hover tests. Tests were made with the UH-1M hovering over a given point on the gage line at rotor heights of 44 and 66 ft above the paved surface. Data were recorded at 90-deg rotation increments. These data are shown in table 13.

24. Fly-by tests. No fly-by tests were made with the UH-1M because of the limited time available.

CH-47 helicopter

25. Lift-off tests. Tests were made with the CH-47 positioned so that a point equidistant between its rotor hubs was over a given point on the gage line. Data were recorded as the aircraft lifted off the pavement. The aircraft was rotated in 90-deg increments for each succeeding test and the data obtained are shown in table 14.

26. Hover tests. Tests were conducted with the CH-47 hovering at rotor heights of 50 and 90 ft above the pavement and centered over a given point above the gage line. Data were recorded as the aircraft rotated in 30-deg increments and are shown in table 15.

27. Fly-by tests. Fly-by tests were not made because of the limited size of the test area and large size of the CH-47.

CH-54 helicopter

28. Tests were made utilizing the CH-54 helicopter at Ft. Rucker, Ala. The instrumentation layout was the same as described previously herein for the tests at the Apalachicola test site. The weights of the

CH-54 aircraft, which varied during the test series because of fuel consumption, are shown in the data tables.

29. Lift-off tests. Lift-off tests were simulated by hovering the aircraft just off the runway surface, then lifting it upward and rotating 30 deg into position for the next test. This procedure was selected by the pilot of the aircraft so as to reduce flying time and pilot fatigue. Two series of lift-off tests were made at gross weights of 29,400 and 39,800 lb. Lift-off tests could not be conducted for the 47,000-lb maximum gross weight condition because the cargo load extended below the aircraft about 15 ft. The lift-off velocity data obtained are shown in table 16.

30. Hover tests. Three series of tests were made with the CH-54 hovering 40 ft above a given point on the gage line, the variable in the tests being the gross weights, which were 28,600, 38,000, and 47,000 lb. During each series the aircraft was rotated in 30-deg increments. Data obtained are presented in table 17.

31. Other test series were run with the CH-54 hovering 80 ft over a given point on the gage line. Aircraft gross weights for these tests were 27,400, 38,000, and 45,000 lb. Data for this series of tests are given in table 18.

32. Fly-by tests. A total of six fly-by tests were made with the CH-54 flying over a given point on the gage line. The aircraft was flown at a slow, steady speed with the rotor 28 ft above the ground surface. Gross aircraft weights were 27,400, 38,000, and 45,000 lb. Data for the fly-by tests are shown in table 19.

Table 1  
Downwash Velocities, OH-58A Lift-Off Tests  
Helicopter Gross Weight, 3000 lb; Disc Load, 3.26 psf;  
Rotor Height Above Ground, 10 ft

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Headings, deg*											
		0 deg	30 deg	60 deg	90 deg	120 deg	150 deg	180 deg	210 deg	240 deg	270 deg	300 deg	330 deg
20	0.3	39	38	41	39	30	1	22	23	36	37	38	38
30	0.3	47	43	43	45	47	43	25	45	42	45	45	45
	1.0	43	43	40	42	42	43	51	39	42	41	41	43
	2.0	40	36	36	39	22	44	48	41	43	44	44	40
	3.0	29	12	10	13	22	34	29	24	26	29	28	22
	4.0	18	--	--	--	--	20	10	20	17	18	20	10
	5.0	--	--	--	--	1	5	--	--	5	--	6	--
40	6.0	--	--	--	--	--	14	--	--	--	--	--	--
	0.3	26	38	35	37	42	38	37	43	42	45	42	40
50	0.3	19	19	19	21	23	25	18	20	22	23	21	15
	1.0	36	41	31	38	40	45	31	30	37	38	34	18
	2.0	24	16	18	15	21	29	21	15	21	20	20	20
	3.0	24	19	20	12	18	37	18	14	18	--	21	18
	4.0	9	7	4	--	5	23	4	5	6	--	7	7
	5.0	8	--	--	--	--	23	--	--	6	8	--	--
70	6.0	--	--	--	--	--	20	--	--	--	--	--	--
	0.3	23	24	23	23	26	28	14	18	11	26	24	23
	1.0	18	19	15	18	20	24	9	16	19	16	18	15
	2.0	17	18	13	14	18	25	9	18	17	20	15	10
	3.0	20	14	16	41	18	35	10	10	19	21	22	17
	4.0	9	--	8	--	12	23	--	4	9	9	8	6
80	5.0	7	--	--	--	5	23	--	--	8	9	5	6
	6.0	4	--	4	--	--	17	--	--	--	7	--	7
90	0.3	9	9	8	10	13	15	2	9	11	13	12	11
	0.3	15	10	13	15	18	20	3	12	13	16	15	12
	1.0	--	--	--	--	--	--	--	--	--	--	--	--
	2.0	19	16	18	19	21	28	5	13	7	23	17	19
	3.0	8	10	11	10	13	19	--	8	10	14	11	10
	4.0	--	8	8	6	10	15	--	6	6	10	10	6
100	5.0	3	--	--	--	--	15	--	--	--	3	--	--
	6.0	8	6	8	7	7	7	2	4	5	9	5	6
100	0.3	11	9	9	12	14	18	3	9	11	16	12	9
110	0.3	10	13	12	12	16	18	3	17	11	15	14	10
	1.0	20	14	14	17	18	24	6	12	14	18	18	14
	2.0	15	15	15	16	17	20	5	15	12	18	16	8
	3.0	18	16	18	20	20	31	8	16	17	20	18	17
	4.0	--	--	--	--	--	10	--	--	--	--	--	--
	5.0	--	--	--	--	--	--	--	--	--	--	--	--
130	6.0	14	11	10	11	13	20	4	10	10	15	9	14
	0.3	11	12	11	11	14	17	6	10	10	15	13	--
140	0.3	6	4	4	8	9	12	--	4	--	8	7	--
150	0.3	--	--	6	6	6	8	--	--	--	6	--	--
	1.0	2	--	4	4	6	8	--	--	--	4	4	--
	2.0	--	--	--	--	7	4	--	--	--	6	6	--
	3.0	8	6	13	13	11	13	--	3	15	11	9	--
	4.0	15	11	15	13	14	21	5	3	17	16	14	2
	5.0	7	6	10	9	14	19	--	2	5	12	11	--
160	6.0	12	8	12	11	15	19	--	7	5	14	13	5
	0.3	6	--	6	6	8	10	--	--	--	5	--	--

\* Heading of helicopter nose relative to line of measurement points. Helicopter at heading of zero degrees faces all measurement points.

Table 2

Downwash Velocities, CH-58A Hover Tests  
Helicopter Gross Weight, 3200 lb; Disc Load, 3.26 psf;  
Rotor Height Above Ground, 35 and 13 ft

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Rotor Heights Above Ground, ft, and Headings, deg*															
		35 ft								13 ft							
		0 deg	90 deg	180 deg	270 deg	0 deg	30 deg	60 deg	90 deg	120 deg	150 deg	180 deg	210 deg	240 deg	270 deg	300 deg	330 deg
20	0.3	33	51	42	49	49	44	51	50	54	56	49	49	50	55	51	45
30	0.3	34	44	40	34	45	54	45	51	54	54	44	48	50	47	46	50
	1.0	28	33	29	32	37	39	43	40	38	39	39	30	31	39	39	39
	2.0	35	33	30	25	28	31	39	36	31	43	45	20	26	34	33	36
	3.0	17	15	17	6	8	5	15	14	16	28	31	5	5	13	8	12
	4.0	17	13	23	--	18	--	6	5	21	29	40	--	5	7	9	7
	5.0	11	5	15	--	10	--	--	--	10	25	29	--	--	--	--	--
	6.0	--	--	--	--	5	--	--	--	6	16	16	--	--	--	--	--
40	0.3	37	34	35	30	32	25	35	37	37	31	26	34	33	40	38	43
50	0.3	13	17	15	15	18	12	17	17	17	--	--	8	11	16	--	26
	1.0	24	27	22	21	26	22	33	23	24	--	--	12	20	24	12	22
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	3.0	17	14	20	15	10	15	20	15	18	--	6	--	18	19	6	18
	4.0	12	14	10	7	7	3	8	7	10	--	5	--	6	6	--	6
	5.0	--	16	13	33	1	--	9	6	12	--	6	--	--	--	--	--
	6.0	6	6	8	--	--	--	--	1	3	--	5	--	--	--	--	--
60	0.3	--	15	--	--	11	15	8	17	13	--	--	--	--	--	--	--
70	0.3	--	18	--	--	--	18	17	15	8	--	--	--	--	--	--	--
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	2.0	--	--	--	--	5	--	--	--	--	8	13	8	3	17	--	7
	3.0	--	--	--	--	5	--	--	--	5	9	12	8	5	19	--	7
	4.0	--	--	--	--	2	--	--	--	4	8	8	--	--	11	--	5
	5.0	--	--	--	--	7	--	--	1	7	7	10	8	--	16	8	--
	6.0	--	--	--	--	1	--	--	--	3	1	4	3	--	8	1	--
100	0.3	--	--	--	--	--	--	--	--	--	6	--	--	--	6	--	3
110	0.3	--	--	--	--	--	--	--	--	--	2	--	--	--	7	2	--
	1.0	--	--	--	--	--	--	--	--	--	5	--	--	--	10	2	--
	2.0	--	--	--	--	--	--	--	--	--	4	--	--	--	8	--	--
	3.0	--	--	--	--	--	--	--	--	--	3	--	--	--	8	--	--
	4.0	--	--	--	--	--	--	--	--	8	2	10	--	4	17	--	8
	5.0	--	--	--	--	--	--	--	--	8	7	8	--	3	18	--	7
	6.0	--	--	--	--	--	--	--	--	--	6	--	--	--	9	--	3
120	0.3	--	--	--	--	3	--	--	--	3	--	7	3	1	12	3	5
140	0.3	--	--	--	--	4	--	--	--	--	5	--	--	--	8	2	2
150	0.3	--	--	--	--	9	--	--	--	7	8	12	--	4	12	3	--
	1.0	--	--	--	--	9	--	--	--	10	10	12	--	6	13	5	8
	2.0	--	--	--	--	11	--	--	--	16	14	16	--	5	14	7	9
	3.0	--	--	--	--	--	--	--	--	3	--	2	--	--	3	--	--
	4.0	--	--	--	--	--	--	--	--	--	--	--	--	--	1	--	--
	5.0	--	--	--	--	0	0	0	0	11	--	10	--	--	11	--	7
	6.0	--	--	--	--	--	--	--	--	3	--	--	--	--	2	--	--
160	0.3	--	--	--	--	1	--	--	--	1	--	--	--	--	3	--	--
170	0.3	--	--	--	--	7	--	--	--	6	5	7	--	--	6	--	4
190	0.3	--	--	--	--	9	--	--	--	6	4	8	--	--	10	5	7

\* Heading of helicopter nose relative to line of measurement points. Helicopter at heading of zero degrees faces all measurement points.

Table 3

Downwash Velocities, OH-58A Fly-By Tests

Helicopter Gross Weight, 3200 and 3000 lb; Disc Load, 3.07 psf;  
Rotor Heights Above Ground, 16 and 21 ft

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Gross Aircraft Weights, lb, Rotor Heights Above Ground, ft, and Headings, deg*			
		3200 lb; 16 ft		3000 lb; 21 ft	
		90 deg	270 deg	90 deg	270 deg
20	0.3	28	10	--	--
30	0.3	49	40	5	18
	1.0	41	37	6	19
	2.0	39	44	7	24
	3.0	16	34	4	18
	4.0	7	27	9	27
	5.0	10	7	9	38
	6.0	--	--	11	24
40	0.3	34	45	7	39
50	0.3	17	23	3	22
	1.0	28	40	6	40
	2.0	21	17	3	24
	3.0	20	23	7	25
	4.0	8	13	5	8
	5.0	14	13	9	5
	6.0	7	4	6	--
70	0.3	23	21	--	22
	1.0	20	20	--	18
	2.0	18	20	--	15
	3.0	18	23	--	20
	4.0	10	11	--	9
	5.0	9	12	--	6
	6.0	5	7	--	3
80	0.3	12	4	--	12
90	0.3	11	11	--	26
	1.0	--	--	--	--
	2.0	18	20	4	24
	3.0	11	10	--	17
	4.0	10	7	3	8
	5.0	3	6	--	2
	6.0	8	8	--	4
100	0.3	6	10	--	13
110	0.3	7	10	--	12
	1.0	11	14	--	15
	2.0	12	17	7	10
	3.0	16	22	12	20
	4.0	--	3	--	--
	5.0	--	--	--	--
	6.0	11	14	10	10

\* Heading of helicopter nose relative to line of measurement points. Helicopter at heading of zero degrees faces all measurement points.



Table 4  
Downwash Velocities, OH-6A Lift-Off Tests  
Helicopter Gross Weight, 1800 lb; Disc Load, 3.31 psf;  
Rotor Height Above Ground, 10 ft

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Headings, deg*											
		0 deg	30 deg	60 deg	90 deg	120 deg	150 deg	180 deg	210 deg	240 deg	270 deg	300 deg	330 deg
20	0.3	37	44	48	46	48	52	48	53	45	47	46	45
30	0.3	27	31	28	33	29	37	41	39	31	40	34	33
	1.0	14	14	20	20	14	25	29	25	20	29	23	19
	2.0	19	18	16	19	15	24	35	22	24	25	24	16
	3.0	5	10	2	4	3	10	14	5	4	6	4	2
	4.0	10	1	--	--	5	8	14	5	--	6	--	--
	5.0	--	3	--	--	--	--	10	--	--	--	--	--
	6.0	--	--	--	--	--	--	--	--	--	3	--	--
40	0.3	--	--	23	23	21	18	23	7	27	13	23	23
50	0.3	--	--	1	13	3	--	--	--	--	--	10	6
	1.0	--	--	2	20	12	--	--	--	--	--	18	11
	2.0	--	--	4	14	6	--	--	--	--	--	10	9
	3.0	--	--	1	14	--	--	--	--	--	--	15	10
	4.0	--	--	1	6	--	--	--	--	--	--	7	2
	5.0	--	--	4	--	1	--	--	--	--	--	6	4
	6.0	--	--	2	--	--	1	3	--	--	--	--	--
60	0.3	--	--	--	14	--	--	--	--	--	--	--	1
70	0.3	--	--	--	11	--	1	--	--	--	--	--	--
	1.0	--	--	--	8	--	1	--	--	--	--	--	--
	2.0	--	--	--	5	--	2	--	--	--	--	--	--
	3.0	--	--	--	3	--	--	--	--	--	--	--	--
	4.0	--	--	--	--	--	--	--	--	--	--	--	--
	5.0	--	--	--	--	--	--	--	--	--	--	--	--
	6.0	--	--	--	--	--	--	--	--	--	--	--	--
80	0.3	--	--	3	--	--	7	--	5	--	8	--	--
90	0.3	--	--	--	--	--	--	2	--	4	--	--	--
	1.0	--	--	--	--	--	--	--	4	--	--	--	--
	2.0	--	1	10	--	--	10	--	7	--	13	--	--
	3.0	--	3	9	--	--	9	--	8	--	13	--	--
	4.0	--	--	6	--	--	5	--	6	--	8	--	--
	5.0	6	3	8	--	--	9	1	6	--	10	--	--
	6.0	--	--	1	--	--	2	--	1	--	4	--	2
100	0.3	--	--	--	--	--	3	--	--	--	5	--	--
110	0.3	--	--	--	--	--	--	--	--	--	--	--	--
	1.0	--	--	--	--	--	--	2	--	--	2	2	--
	2.0	--	--	--	--	--	--	2	--	--	--	2	--
	3.0	--	--	--	--	5	--	--	--	--	--	3	--
	4.0	--	--	--	--	6	--	--	4	8	4	--	--
	5.0	--	--	--	--	5	--	--	3	8	--	--	--
	6.0	--	--	--	--	7	--	--	--	--	--	--	--
120	0.3	--	--	--	--	--	--	--	--	--	7	--	--

\* Heading of helicopter nose relative to line of measurement points. Helicopter at heading of zero degrees faces all measurement points.

Table 5

Downwash Velocities, OH-6A Hover Tests

Helicopter Gross Weight, 1800 lb; Disc Load, 3.31 psf;  
Rotor Height Above Ground, 34 ft

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Headings, deg*			
		0 deg	90 deg	180 deg	270 deg
20	0.3	32	35	47	42
30	0.3	19	31	36	33
	1.0	12	15	19	19
	2.0	12	16	19	18
	3.0	3	5	8	3
	4.0	9	5	11	--
	5.0	4	--	4	--
	6.0	5	--	5	--
40	0.3	--	--	31	22
50	0.3	--	--	9	--
	1.0	--	--	13	--
	2.0	--	--	5	--
	3.0	--	--	4	--
	4.0	--	--	--	--
	5.0	--	--	--	--
	6.0	--	--	--	--

\* Heading of helicopter nose relative to line of measurement points.  
Helicopter at heading of zero degrees faces all measurement points.

Table 6

Downwash Velocities, OH-6A Fly-By Tests

Helicopter Gross Weight, 1800 lb; Disc Load, 3.31 psf;  
Rotor Height Above Ground, 14 ft

<u>Horizontal Distance from Rotor Hub(s), ft</u>	<u>Velocity Point Height Above Ground, ft</u>	<u>Downwash Velocities mph, at Indicated Headings, deg*</u>	
		<u>90 deg</u>	<u>270 deg</u>
20	0.3	44	36
	30		
30	0.3	34	18
	1.0	21	12
	2.0	14	10
	3.0	--	1
	4.0	--	--
	5.0	--	--
	6.0	--	--
40	0.3	21	10
50	0.3	--	7
	1.0	--	5
	2.0	--	5
	3.0	--	4
	4.0	--	1
	5.0	--	--
	6.0	--	--

\* Heading of helicopter nose relative to line of measurement points. Helicopter at heading of zero degrees faces all measurement points.

Table 7

Downwash Velocities, AH-1G Lift-Off Tests

Helicopter Gross Weight, 9500 lb; Disc Load, 6.25 psf;  
Rotor Height Above Ground, 14 ft

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Headings, deg*											
		0	30	60	90	120	150	180	210	240	270	300	330
		deg	deg	deg	deg	deg	deg	deg	deg	deg	deg	deg	deg
20	0.3	--	--	49	--	29	24	--	37	16	22	32	30
	30	--	51	72	43	75	74	24	74	68	62	68	63
30	1.0	--	--	63	--	62	69	--	57	51	47	51	49
	2.0	--	--	75	--	75	76	--	74	70	65	68	70
	3.0	--	--	59	--	59	64	--	78	60	62	62	64
	4.0	--	--	46	--	40	52	--	75	70	77	70	75
	5.0	--	--	21	--	9	12	--	52	64	68	54	63
	6.0	--	--	--	--	--	--	--	22	45	41	38	24
40	0.3	--	71	67	71	70	70	60	68	74	71	72	72
	1.0	--	55	--	62	--	--	49	--	--	--	--	--
	2.0	--	72	--	74	--	--	64	--	--	--	--	--
	3.0	--	51	--	55	--	--	43	--	--	--	--	--
	4.0	--	51	--	33	--	--	37	--	--	--	--	--
	5.0	--	29	--	10	--	--	21	--	--	--	--	--
50	6.0	--	9	--	--	--	--	15	--	--	--	--	--
	0.3	64	63	40	64	37	39	57	40	49	46	44	49
	1.0	--	--	70	--	65	67	--	69	74	74	71	75
	2.0	--	--	39	--	40	41	--	31	44	48	46	47
	3.0	--	--	50	--	42	43	--	45	55	59	59	51
	4.0	--	--	22	--	16	18	--	24	28	33	30	27
60	5.0	--	--	19	--	10	22	--	28	31	36	28	29
	6.0	--	--	5	--	--	5	--	12	18	28	16	14
	0.3	74	33	--	39	--	--	28	--	--	--	--	--
	1.0	49	66	--	68	--	--	43	--	--	--	--	--
	2.0	72	35	--	44	--	--	28	--	--	--	--	--
	3.0	57	41	--	45	--	--	32	--	--	--	--	--
70	4.0	50	20	--	18	--	--	15	--	--	--	--	--
	5.0	15	21	--	18	--	--	24	--	--	--	--	--
	6.0	--	10	--	6	--	--	27	--	--	--	--	--
	0.3	63	--	44	--	45	39	--	38	46	51	49	49
	1.0	--	--	38	--	41	31	--	37	43	44	46	40
	2.0	--	--	35	--	33	30	--	29	39	40	41	33
80	3.0	--	--	47	--	38	36	--	44	46	50	46	48
	4.0	--	--	23	--	15	14	--	19	19	25	24	26
	5.0	--	--	27	--	18	12	--	23	25	31	32	31
	6.0	--	--	15	--	13	12	--	18	14	20	20	14
	0.3	34	39	25	42	30	25	13	26	28	36	34	30
	1.0	66	40	--	36	--	--	21	--	--	--	--	--
90	2.0	44	35	--	36	--	--	19	--	--	--	--	--
	3.0	50	36	--	42	--	--	25	--	--	--	--	--
	4.0	18	17	--	18	--	--	13	--	--	--	--	--
	5.0	20	17	--	20	--	--	14	--	--	--	--	--
	6.0	--	15	--	32	--	--	8	--	--	--	--	--
	0.3	--	26	31	27	31	30	--	28	31	36	36	38
90	1.0	--	--	--	--	--	--	--	--	--	--	--	--
	2.0	--	--	38	--	36	38	--	39	44	47	43	46
	3.0	--	--	23	--	22	21	--	29	34	40	31	31
	4.0	--	--	15	--	15	20	--	19	22	26	18	20
	5.0	--	--	9	--	9	10	--	12	18	20	21	16
	6.0	--	--	17	--	13	13	--	15	17	19	18	20

(Continued)

\* Heading of helicopter nose relative to line of measurement points. Helicopter at heading of zero degrees faces all measurement points.

Table 7 (Concluded)

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Headings, deg											
		0 deg	30 deg	60 deg	90 deg	120 deg	150 deg	180 deg	210 deg	240 deg	270 deg	300 deg	330 deg
100	0.3	39	25	26	28	31	31	16	30	35	33	33	31
	1.0	37	--	--	--	--	--	--	--	--	--	--	--
	2.0	32	38	--	40	--	--	22	--	--	--	--	--
	3.0	40	27	--	28	--	--	14	--	--	--	--	--
	4.0	19	18	--	17	--	--	12	--	--	--	--	--
	5.0	21	9	--	11	--	--	3	--	--	--	--	--
	6.0	12	14	--	14	--	--	10	--	--	--	--	--
110	0.3	24	24	23	27	28	25	20	25	27	27	26	22
	1.0	--	--	29	--	31	30	--	30	34	33	31	29
	2.0	--	--	30	--	23	33	--	30	32	35	35	32
	3.0	--	--	40	--	35	44	--	39	41	46	43	40
	4.0	--	--	18	--	12	19	--	17	18	22	16	16
	5.0	--	--	--	--	--	--	--	--	--	--	--	--
	6.0	--	--	31	--	31	28	--	34	35	39	30	32
120	0.3	28	20	12	25	9	10	14	8	15	16	14	12
	1.0	--	28	--	28	--	--	17	--	--	--	--	--
	2.0	37	28	--	29	--	--	20	--	--	--	--	--
	3.0	24	37	--	38	--	--	30	--	--	--	--	--
	4.0	14	3	--	12	--	--	--	--	--	--	--	--
	5.0	13	--	--	--	--	--	--	--	--	--	--	--
	6.0	17	24	--	30	--	--	22	--	--	--	--	--
130	0.3	24	6	22	10	25	25	--	24	25	30	25	24
140	0.3	20	22	15	22	19	18	5	18	22	23	16	20
	1.0	25	--	--	--	--	--	--	--	--	--	--	--
	2.0	26	--	--	--	--	--	--	--	--	--	--	--
	3.0	33	--	--	--	--	--	--	--	--	--	--	--
	4.0	7	--	--	--	--	--	--	--	--	--	--	--
	5.0	--	--	--	--	--	--	--	--	--	--	--	--
	6.0	29	--	--	--	--	--	--	--	--	--	--	--
150	0.3	7	18	17	17	18	17	9	10	19	22	15	18
	1.0	--	--	13	--	15	16	--	12	10	20	12	17
	2.0	--	--	13	--	15	16	--	14	22	20	16	20
	3.0	--	--	16	--	19	17	--	18	21	22	18	19
	4.0	--	--	29	--	30	27	--	31	32	35	31	33
	5.0	--	--	19	--	22	16	--	23	23	28	25	26
	6.0	--	--	18	--	21	16	--	22	22	26	25	26
160	0.3	22	15	12	18	14	12	--	11	17	19	12	16
	1.0	--	13	--	15	--	--	6	--	--	--	--	--
	2.0	--	16	--	20	--	--	9	--	--	--	--	--
	3.0	--	17	--	18	--	--	17	--	--	--	--	--
	4.0	--	30	--	27	--	--	22	--	--	--	--	--
	5.0	--	20	--	19	--	--	37	--	--	--	--	--
	6.0	--	20	--	20	--	--	14	--	--	--	--	--
170	0.3	16	13	11	14	11	10	--	8	13	17	10	15
180	0.3	13	8	--	12	--	--	--	--	--	--	--	--
	1.0	16	--	--	--	--	--	--	--	--	--	--	--
	2.0	18	--	--	--	--	--	--	--	--	--	--	--
	3.0	19	--	--	--	--	--	--	--	--	--	--	--
	4.0	32	--	--	--	--	--	--	--	--	--	--	--
	5.0	22	--	--	--	--	--	--	--	--	--	--	--
	6.0	20	--	--	--	--	--	--	--	--	--	--	--

Table 8

Downwash Velocities, AH-1G Hover Tests

Helicopter Gross Weight, 9500 lb; Disc Load, 6.25 psf;  
Rotor Height Above Ground, 44 ft

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Headings, deg*					
		0 deg	30 deg	90 deg	120 deg	180 deg	270 deg
20	0.3	30	41	20	39	14	44
30	0.3	62	46	57	71	40	61
	1.0	48	35	45	46	30	55
	2.0	68	53	50	53	44	70
	3.0	57	45	57	41	41	49
	4.0	64	51	58	38	56	59
	5.0	68	49	46	30	54	56
	6.0	60	47	34	30	40	45
40	0.3	63	60	67	67	60	66
50	0.3	45	45	49	40	43	46
	1.0	73	67	71	64	70	70
	2.0	45	40	46	39	42	42
	3.0	55	51	52	53	55	56
	4.0	43	39	29	39	36	34
	5.0	56	55	31	49	46	42
	6.0	35	23	13	42	36	22
70	0.3	46	46	54	54	47	51
	1.0	43	41	44	45	39	42
	2.0	38	32	39	46	36	36
	3.0	53	46	48	53	54	45
	4.0	27	23	23	32	31	23
	5.0	40	28	23	38	40	24
	6.0	32	32	14	26	26	18
80	0.3	28	27	32	34	35	27
90	0.3	34	28	37	35	36	35
	1.0	--	--	--	--	--	--
	2.0	45	44	46	49	43	42
	3.0	34	32	33	41	31	29
	4.0	24	24	23	27	18	18
	5.0	28	14	21	26	21	15
	6.0	25	23	20	26	20	27
100	0.3	37	30	32	35	32	31
110	0.3	25	27	25	28	28	22
	1.0	34	32	32	36	36	31
	2.0	38	32	35	35	37	33
	3.0	48	40	41	44	44	44
	4.0	24	15	15	21	20	29
	5.0	--	--	--	--	--	--
	6.0	34	33	35	44	35	32
120	0.3	12	13	11	14	18	12
130	0.3	26	28	26	28	29	24
140	0.3	20	36	19	24	21	20
150	0.3	20	18	20	24	19	17
	1.0	21	20	18	23	32	20
	2.0	22	22	24	27	27	20
	3.0	22	19	20	23	24	19
	4.0	34	33	31	33	40	26
	5.0	25	25	23	35	28	29
	6.0	21	23	25	28	24	24
160	0.3	16	15	15	14	13	26
170	0.3	15	12	11	11	13	15

\* Heading of helicopter nose relative to line of measurement points. Helicopter at heading of zero degrees faces all measurement points.

Table 9

Downwash Velocities, AH-1G Fly-By Tests

Helicopter Gross Weight, 9500 lb; Disc Load, 6.25 psf;  
Rotor Height Above Ground, 22 ft

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Headings, deg*	
		90 deg	270 deg
20	0.3	10	21
30	0.3	51	52
	1.0	36	51
	2.0	40	59
	3.0	37	46
	4.0	43	46
	5.0	32	26
	6.0	25	11
40	0.3	48	54
50	0.3	25	32
	1.0	41	54
	2.0	26	40
	3.0	35	45
	4.0	41	16
	5.0	24	11
	6.0	18	--
70	0.3	30	35
	1.0	24	36
	2.0	22	29
	3.0	30	39
	4.0	17	13
	5.0	21	12
	6.0	16	7
80	0.3	12	22

(Continued)

\* Heading of helicopter nose relative to line of measurement points.  
Helicopter at heading of zero degrees faces all measurement points.

Table 9 (Concluded)

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Headings, deg	
		90 deg	270 deg
90	0.3	29	25
	1.0	--	--
	2.0	24	34
	3.0	18	34
	4.0	14	19
	5.0	11	10
	6.0	16	11
100	0.3	17	21
110	0.3	14	17
	1.0	19	22
	2.0	22	27
	3.0	30	37
	4.0	7	12
	5.0	--	--
	6.0	29	32
120	0.3	--	5
130	0.3	11	15
140	0.3	4	8
150	0.3	3	7
	1.0	4	12
	2.0	5	7
	3.0	10	15
	4.0	21	25
	5.0	13	14
	6.0	15	15
160	0.3	9	9
170	0.3	6	5



Table 10

## Downwash Velocities, UH-1H Lift-Off Tests

Helicopter Gross Weight, 9500 lb; Disc Load, 5.25 psf;  
Rotor Height Above Ground, 14 ft

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Headings, deg*									
		0 deg	30 deg	60 deg	90 deg	120 deg	150 deg	180 deg	210 deg	240 deg	270 deg
20	0.3	--	--	19	25	34	--	--	--	23	63
30	0.3	--	--	65	--	57	--	--	--	57	41
	1.0	--	--	59	61	63	--	--	--	53	48
	2.0	--	--	62	63	59	--	--	--	58	51
	3.0	--	--	47	54	53	--	--	--	54	47
	4.0	--	--	35	51	33	--	--	--	54	46
	5.0	--	--	8	35	49	--	--	--	52	31
	6.0	--	--	--	12	50	--	--	--	31	16
40	0.3	--	--	62	52	60	64	63	66	64	39
50	0.3	--	--	35	--	--	61	61	63	--	14
	1.0	--	--	58	--	--	60	62	61	--	43
	2.0	--	--	32	38	39	57	62	58	40	30
	3.0	--	--	32	36	41	40	61	43	46	40
	4.0	--	--	12	22	27	29	66	41	21	25
	5.0	--	--	--	15	30	13	62	21	17	36
	6.0	--	--	--	0	13	--	47	7	--	20
60	0.3	--	--	--	--	--	35	47	55	--	--
70	0.3	--	--	34	39	40	35	27	35	44	28
	1.0	--	--	29	35	36	50	56	54	35	26
	2.0	--	--	26	27	34	27	36	34	36	27
	3.0	--	--	35	--	37	22	54	45	37	--
	4.0	--	--	14	--	17	14	39	24	19	17
	5.0	--	--	18	--	18	13	56	25	24	22
	6.0	--	--	12	--	15	--	36	12	--	20
80	0.3	--	--	24	19	26	--	--	--	30	17
90	0.3	19	21	17	23	25	37	33	37	27	13
	1.0	--	--	--	--	--	30	30	31	--	--
	2.0	24	31	23	29	40	24	28	33	36	25
	3.0	12	22	17	20	31	--	37	--	22	20
	4.0	20	28	16	19	32	--	22	17	19	22
	5.0	--	--	14	12	20	14	35	25	18	17
	6.0	--	--	17	15	20	7	29	21	17	19
100	0.3	13	19	18	24	28	22	19	24	23	16
110	0.3	13	17	16	20	21	21	21	25	21	16
	1.0	15	22	19	24	27	--	--	--	26	21
	2.0	4	25	22	25	28	24	32	33	29	23
	3.0	23	36	31	33	25	15	25	22	34	31
	4.0	--	9	8	8	14	15	22	17	8	9
	5.0	--	--	--	--	--	8	17	11	--	--
	6.0	20	25	22	24	32	11	19	15	25	28
120	0.3	--	--	4	7	8	19	19	23	7	2
130	0.3	--	15	16	19	23	17	20	20	21	18
	1.0	--	--	--	--	--	22	26	26	--	--
	2.0	--	--	--	--	--	23	26	28	--	--
	3.0	--	--	--	--	--	28	35	30	--	--
	4.0	--	--	--	--	--	4	9	12	--	--
	5.0	--	--	--	--	--	--	--	--	--	--
	6.0	--	--	--	--	--	23	26	26	--	--
140	0.3	--	7	9	10	12	--	9	8	13	7
150	0.3	--	5	8	8	10	16	24	21	10	9
	1.0	--	7	7	8	12	--	--	--	9	10
	2.0	--	8	8	8	13	--	--	--	13	12
	3.0	--	14	15	15	15	--	--	--	17	16
	4.0	--	25	25	27	23	--	--	--	29	28
	5.0	--	16	12	18	21	--	--	--	20	20
	6.0	--	18	14	17	21	--	--	--	19	22
160	0.3	--	8	9	8	8	8	16	15	12	10
170	0.3	--	--	--	--	--	4	16	14	--	--
	1.0	--	--	--	--	--	4	15	12	--	--
	2.0	--	--	--	--	--	--	16	23	--	--
	3.0	--	--	--	--	--	7	18	19	--	--
	4.0	--	--	--	--	--	22	31	31	--	--
	5.0	--	--	--	--	--	17	23	22	--	--
	6.0	--	--	--	--	--	15	22	23	--	--
180	0.3	--	10	10	8	15	3	13	9	14	11

\* Heading of helicopter nose relative to line of measurement points. Helicopter at heading of zero degrees faces all measurement points.

Table 11

Downwash Velocities, UH-1H Fly-By Tests

Helicopter Gross Weight 9500 lb; Disc Load, 5.25 psf;  
Rotor Height Above Ground, 20 ft

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Headings, deg*	
		90 deg	270 deg
20	0.3	51	27
	30		
30	0.3	42	55
	1.0	42	49
	2.0	40	55
	3.0	19	45
	4.0	--	43
	5.0	--	20
	6.0	--	5
40	0.3	30	57
50	0.3	20	38
	1.0	31	60
	2.0	16	31
	3.0	16	32
	4.0	8	15
	5.0	8	10
	6.0	8	5
70	0.3	22	39
	1.0	13	34
	2.0	4	30
	3.0	19	31
	4.0	12	13
	5.0	10	16
	6.0	7	12
80	0.3	12	21
90	0.3	--	15
	1.0	--	--
	2.0	--	28
	3.0	--	18
	4.0	--	16
	5.0	--	9
	6.0	4	14
110	0.3	--	13
	1.0	--	18
	2.0	--	37
	3.0	--	39
	4.0	--	--
	5.0	--	--
	6.0	--	23

\* Heading of helicopter nose relative to line of measurement points.  
Helicopter at heading of zero degrees faces all measurement points.

Table 12

## Downwash Velocities, UH-1M Lift-Off Tests

Helicopter Gross Weight, 9500 lb; Disc Load, 5.25 psf;  
Rotor Height Above Ground, 14 ft

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Headings, deg*												
		0 deg	30 deg	60 deg	90 deg	120 deg	150 deg	180 deg	210 deg	240 deg	270 deg	300 deg	330 deg	
20	0.3	59	53	54	34	69	72	56	75	22	50	56	64	
30	0.3	70	68	76	72	68	64	56	63	64	63	72	70	
	1.0	61	60	64	62	59	61	51	62	55	60	61	63	
	2.0	66	65	68	71	69	60	63	70	64	69	70	72	
	3.0	52	47	51	61	58	43	62	59	59	62	58	53	
	4.0	35	47	32	66	50	34	69	59	61	41	50	41	
	5.0	18	33	12	22	41	28	66	41	61	21	28	15	
	6.0	--	--	--	--	26	13	47	26	33	2	4	--	
40	0.3	64	57	58	51	58	56	49	67	70	72	69	67	
50	0.3	37	39	35	42	42	36	29	42	42	43	40	40	
	1.0	59	33	39	64	66	50	48	66	66	66	66	58	
	2.0	35	35	36	39	42	31	37	43	43	44	40	35	
	3.0	37	39	39	41	52	43	52	48	47	45	48	41	
	4.0	19	24	16	21	35	23	38	23	34	22	23	23	
	5.0	14	21	14	27	37	28	55	26	29	24	16	18	
	6.0	6	--	6	30	11	10	36	15	12	16	6	5	
70	0.3	41	41	41	44	47	40	40	50	44	50	46	40	
	1.0	37	34	33	40	45	33	36	43	45	45	40	38	
	2.0	33	33	30	38	44	32	37	41	52	39	34	33	
	3.0	38	39	36	40	52	40	44	54	52	44	48	42	
	4.0	19	19	18	18	24	17	27	21	23	22	22	17	
	5.0	22	23	14	16	28	18	39	24	4	26	18	17	
	6.0	10	16	11	13	12	13	28	10	--	11	10	10	
90	0.3	24	28	28	32	34	28	29	35	31	32	29	29	
	1.0	--	--	--	--	--	--	--	--	--	--	--	--	
	2.0	32	37	37	39	38	32	41	46	42	45	39	37	
	3.0	24	24	28	27	33	21	34	38	28	31	27	26	
	4.0	15	19	21	22	25	17	24	28	21	23	17	17	
	5.0	2	6	3	6	6	--	13	10	5	10	--	1	
	6.0	12	18	16	17	15	13	24	23	13	18	10	14	
100	0.3	14	16	18	21	20	13	21	26	21	22	18	18	
110	0.3	19	21	24	26	27	23	23	33	25	26	22	23	
	1.0	26	27	28	33	28	26	29	35	31	31	29	27	
	2.0	25	17	25	31	31	15	30	33	30	30	24	26	
	3.0	26	29	29	34	34	25	37	35	34	34	29	29	
	4.0	9	15	16	19	16	9	23	19	19	19	14	10	
	5.0	--	--	--	--	--	--	--	--	--	--	--	--	
	6.0	16	22	27	29	20	18	30	27	22	30	19	18	
120	0.3	7	7	12	13	13	8	11	13	11	11	8	8	
130	0.3	19	19	18	28	27	23	24	24	21	28	22	21	
140	0.3	12	12	16	21	18	15	19	14	18	22	13	14	
150	0.3	10	11	16	22	19	12	16	13	16	18	12	12	
	1.0	10	12	16	17	17	12	19	15	17	15	11	13	
	2.0	9	8	17	22	18	12	18	15	15	15	12	11	
	3.0	16	16	18	23	20	16	20	20	18	18	18	16	
	4.0	22	24	28	30	27	26	30	25	27	26	25	23	
	5.0	19	21	25	28	28	18	28	22	23	24	24	20	
	6.0	18	21	25	27	29	18	29	21	21	22	22	21	
160	0.3	10	9	12	17	14	10	15	11	11	14	10	12	
170	0.3	8	9	11	15	13	8	12	10	10	12	10	11	
180	0.3	14	12	17	20	19	12	19	15	16	8	11	17	
190	0.3	5	--	7	11	7	--	10	6	6	7	6	6	

\* Heading of helicopter nose relative to line of measurement points. Helicopter at heading of zero degrees faces all measurement points.

Table 13

## Downwash Velocities, UH-1M Hover Tests

Helicopter Gross Weight, 9500 lb; Disc Load, 5.25 psf;  
Rotor Height Above Ground, 44 and 66 ft

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Rotor Heights Above Ground, ft, and Headings, deg*							
		44 ft				66 ft			
		0 deg	90 deg	180 deg	270 deg	0 deg	90 deg	180 deg	270 deg
20	0.3	45	8	28	15	56	20	37	16
30	0.3	65	75	70	51	67	64	33	70
	1.0	60	63	32	47	33	48	33	61
	2.0	64	70	57	57	68	53	28	72
	3.0	56	66	49	50	53	43	37	61
	4.0	58	62	54	57	59	48	51	68
	5.0	61	49	42	53	58	44	50	68
	6.0	48	33	33	48	48	34	41	43
40	0.3	64	70	65	49	19	64	63	76
50	0.3	44	49	42	48	42	50	42	49
	1.0	63	74	62	73	60	74	57	75
	2.0	39	48	40	46	39	45	39	50
	3.0	55	60	49	56	48	56	54	55
	4.0	36	32	37	39	28	40	37	35
	5.0	40	36	46	49	34	61	58	40
	6.0	23	16	31	30	23	43	46	21
70	0.3	43	53	51	53	50	60	62	54
	1.0	40	49	47	44	40	53	50	53
	2.0	38	46	38	42	46	45	43	44
	3.0	46	49	42	52	50	52	53	55
	4.0	24	25	20	24	23	33	30	27
	5.0	27	35	22	36	26	44	45	34
	6.0	18	13	16	22	24	32	34	19
90	0.3	29	37	36	33	32	37	46	40
	1.0	--	--	--	--	--	--	--	--
	2.0	42	48	46	46	42	49	56	50
	3.0	32	33	25	34	35	41	42	35
	4.0	23	25	17	25	24	31	29	24
	5.0	11	12	2	22	9	20	18	10
	6.0	23	20	16	25	21	25	30	18
100	0.3	23	27	24	20	24	27	38	27
110	0.3	23	30	30	27	28	28	38	33
	1.0	33	38	31	35	34	38	48	37
	2.0	34	38	27	35	31	37	47	36
	3.0	35	40	34	42	32	44	48	39
	4.0	19	19	12	22	19	30	28	27
	5.0	--	--	--	--	--	--	--	--
	6.0	37	26	20	29	26	31	37	26
120	0.3	10	14	13	13	13	14	20	18
130	0.3	25	28	26	27	26	29	30	28
140	0.3	19	22	19	19	16	22	25	21
150	0.3	16	19	17	18	10	25	23	18
	1.0	19	21	17	18	16	27	20	19
	2.0	22	23	17	19	18	26	29	13
	3.0	22	21	19	23	20	25	25	17
	4.0	30	30	27	32	27	34	34	26
	5.0	29	28	20	31	26	30	35	28
	6.0	30	28	20	30	26	32	35	28
160	0.3	16	15	13	26	14	19	27	10
170	0.3	16	13	13	15	12	16	15	15
180	0.3	21	19	19	20	18	20	23	20
190	0.3	11	10	10	12	8	10	13	10

\* Heading of helicopter nose relative to line of measurement points. Helicopter at heading of zero degrees faces all measurement points.

Table 14

Downwash Velocities, CH-47 Lift-Off Tests

Helicopter Gross Weight, 36,000 lb; Disc Load, 6.37 psf;  
Rotor Height Above Ground, 15 ft

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Headings, deg*			
		0 deg	90 deg	180 deg	270 deg
20	0.3	72	52	83	38
30	0.3	75	83	86	72
	1.0	73	76	85	70
	2.0	81	78	90	77
	3.0	84	70	93	71
	4.0	86	82	100	67
	5.0	84	78	93	62
	6.0	72	74	87	60
40	0.3	86	90	78	85
50	0.3	69	67	63	74
	1.0	98	104	87	108
	2.0	70	71	70	75
	3.0	91	97	96	100
	4.0	68	73	73	76
	5.0	95	99	94	127
	6.0	71	77	72	78
70	0.3	74	74	72	80
	1.0	73	75	66	78
	2.0	68	72	70	75
	3.0	92	97	97	103
	4.0	57	58	57	62
	5.0	111	97	84	100
	6.0	64	59	63	69
80	0.3	56	59	51	63
90	0.3	64	68	54	69
	1.0	--	--	--	--
	2.0	82	83	79	88
	3.0	74	73	71	82
	4.0	51	49	45	53
	5.0	61	61	52	60
	6.0	56	58	47	55

(Continued)

\* Heading of helicopter nose relative to line of measurement points.  
Helicopter at heading of zero degrees faces all measurement points.

Table 14 (Concluded)

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Headings, deg			
		0 deg	90 deg	180 deg	270 deg
100	0.3	60	63	52	66
110	0.3	64	62	49	70
	1.0	70	81	56	76
	2.0	75	76	57	79
	3.0	76	76	64	76
	4.0	66	64	58	67
	5.0	--	--	--	--
	6.0	74	69	54	70
120	0.3	49	43	30	51
130	0.3	62	62	44	65
140	0.3	58	59	39	62
150	0.3	--	64	38	61
	1.0	--	69	43	67
	2.0	71	77	47	82
	3.0	55	59	42	59
	4.0	75	79	60	81
	5.0	69	72	54	82
	6.0	67	70	53	69
160	0.3	43	41	28	44
180	0.3	44	46	37	59
190	0.3	44	45	30	50

Table 15

## Downwash Velocities, CH-47 Hover Tests

Helicopter Gross Weight, 36,000 lb; Disc Load, 6.37 paf;  
Rotor Height Above Ground, 50 and 90 ft

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Rotor Heights Above Ground, ft, and Headings, deg*											
		50 ft											
		0 deg	30 deg	60 deg	90 deg	120 deg	150 deg	180 deg	210 deg	240 deg	270 deg	300 deg	330 deg
20	0.3	82	--	29	21	73	94	78	98	32	40	57	81
30	0.3	80	34	38	47	90	84	71	93	72	63	53	68
	1.0	79	49	30	44	79	84	75	94	67	56	55	72
	2.0	78	35	39	48	83	97	77	98	75	64	64	80
	3.0	65	15	21	43	74	92	74	103	71	45	65	76
	4.0	67	15	11	48	70	91	83	102	72	56	69	70
	5.0	62	13	10	48	69	74	83	99	66	54	64	62
	6.0	53	--	14	51	77	63	78	96	54	45	44	43
40	0.3	75	58	57	73	89	79	80	90	102	82	53	58
50	0.3	54	54	59	64	64	55	54	56	78	61	56	41
	1.0	80	71	78	94	92	81	96	101	112	89	85	68
	2.0	59	38	51	65	63	82	62	74	73	61	55	51
	3.0	84	50	60	85	84	88	87	98	90	80	73	66
	4.0	57	36	45	68	64	61	57	68	67	53	53	44
	5.0	78	55	68	94	88	87	81	91	92	72	73	61
	6.0	60	44	54	75	66	66	67	64	74	66	55	45
70	0.3	62	72	73	79	62	62	55	66	--	78	62	49
	1.0	57	76	64	73	59	52	53	66	82	73	60	46
	2.0	58	67	64	69	56	49	58	75	74	70	59	45
	3.0	80	86	90	97	75	67	77	94	104	92	85	60
	4.0	50	57	56	60	81	47	48	58	74	54	53	37
	5.0	75	50	94	94	67	75	79	89	94	83	82	52
	6.0	53	64	61	70	48	61	57	67	59	58	58	38
80	0.3	51	60	58	63	52	43	48	50	--	59	51	30
90	0.3	51	70	69	73	58	45	46	65	77	64	62	35
	1.0	--	--	--	--	--	--	--	--	--	--	--	--
	2.0	72	80	82	89	77	59	60	77	90	82	74	52
	3.0	62	69	68	78	66	52	54	68	77	70	65	43
	4.0	40	46	47	57	50	40	41	51	54	46	45	30
	5.0	40	50	54	66	57	47	47	55	58	49	53	35
	6.0	29	46	43	62	50	45	45	50	62	43	49	33
100	0.3	48	61	62	68	49	40	46	54	64	63	56	29
	1.0	54	68	71	81	61	49	52	65	79	68	65	45
	2.0	38	72	74	80	52	44	48	58	74	69	60	42
	3.0	56	74	73	79	82	49	51	66	77	74	68	44
	4.0	48	56	59	69	51	40	39	58	63	63	60	28
	5.0	--	--	--	--	--	--	--	--	--	--	--	--
	6.0	52	45	56	75	56	50	55	60	60	57	55	41
120	0.3	29	44	47	47	30	25	23	34	43	40	35	20
130	0.3	43	54	65	66	46	41	41	54	62	50	51	32
140	0.3	34	48	47	62	36	38	36	42	60	45	48	21
150	0.3	38	52	56	66	36	37	38	89	57	41	46	23
	1.0	36	55	67	82	36	41	45	50	65	45	52	24
	2.0	36	59	70	85	48	46	48	54	63	53	58	25
	3.0	32	45	53	62	42	37	36	46	39	45	46	24
	4.0	47	64	70	85	56	57	49	64	68	65	64	35
	5.0	43	35	61	76	50	53	44	57	62	53	56	28
	6.0	45	52	62	78	49	52	46	60	63	56	55	28
160	0.3	26	35	41	45	25	27	29	34	37	39	31	20
180	0.3	30	45	46	57	33	31	36	40	44	38	34	27
190	0.3	23	37	42	49	21	25	24	34	40	26	23	10

(Continued)

\* Heading of helicopter nose relative to line of measurement points. Helicopter at heading of zero degrees faces all measurement points.

Table 15 (Concluded)

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Rotor Heights Above Ground, ft, and Headings, deg											
		90 ft											
		0 deg	30 deg	60 deg	90 deg	120 deg	150 deg	180 deg	210 deg	240 deg	270 deg	300 deg	330 deg
20	0.3	76	77	32	35	66	65	107	95	81	26	41	70
30	0.3	62	80	47	42	72	87	61	92	111	61	30	44
	1.0	66	74	45	32	60	76	81	82	89	53	34	54
	2.0	86	82	42	35	57	72	85	70	91	51	37	56
	3.0	85	77	38	21	45	53	76	63	76	46	36	49
	4.0	86	82	43	26	42	53	68	61	83	54	49	49
	5.0	80	78	44	19	33	40	60	55	80	51	52	48
	6.0	76	61	43	28	25	39	62	57	69	46	65	46
40	0.3	62	80	72	68	76	92	90	87	104	87	57	62
50	0.3	46	58	64	65	61	65	63	61	73	67	45	45
	1.0	64	84	92	92	88	96	92	89	104	100	68	71
	2.0	57	63	69	64	60	59	61	57	70	69	48	53
	3.0	81	82	90	88	75	77	58	82	90	91	61	69
	4.0	55	57	86	70	55	61	51	54	62	69	34	39
	5.0	83	76	98	94	75	72	78	81	86	97	60	64
	6.0	61	56	79	76	60	54	55	58	63	74	47	50
70	0.3	57	64	79	84	64	76	69	61	85	37	70	71
	1.0	58	62	77	86	--	75	69	60	79	77	67	65
	2.0	56	54	72	76	58	71	66	64	72	71	72	60
	3.0	79	71	102	107	78	96	92	82	90	96	104	83
	4.0	47	43	66	67	45	58	55	47	55	58	66	80
	5.0	75	60	104	107	68	92	86	77	92	93	81	78
	6.0	58	43	74	75	46	64	64	58	60	65	58	60
80	0.3	47	43	61	64	49	59	55	49	65	64	55	56
90	0.3	47	50	72	72	49	70	65	57	73	71	65	49
	1.0	--	--	--	--	--	--	--	--	--	--	--	--
	2.0	64	59	94	91	63	86	81	68	87	86	79	72
	3.0	56	50	84	82	56	77	72	62	72	76	62	62
	4.0	39	34	60	58	40	53	52	42	44	49	38	44
	5.0	45	38	71	68	39	63	--	48	56	56	42	45
	6.0	43	36	64	64	39	58	56	46	51	53	37	45
100	0.3	44	48	68	66	48	63	60	52	67	67	63	47
110	0.3	40	40	64	--	43	58	52	48	64	68	--	45
	1.0	57	49	76	85	60	72	68	58	70	77	70	52
	2.0	54	50	91	82	51	71	70	57	78	77	69	50
	3.0	59	55	83	83	52	76	73	59	78	79	66	57
	4.0	49	41	77	72	38	69	63	45	67	65	49	45
	5.0	--	--	--	--	--	--	--	--	--	--	--	--
	6.0	54	46	79	79	42	76	69	49	68	59	48	61
120	0.3	28	26	49	48	31	42	40	35	47	51	37	25
130	0.3	44	42	71	70	41	59	54	45	62	67	48	38
140	0.3	46	36	67	66	38	56	48	40	57	61	44	42
150	0.3	37	30	--	66	34	58	48	36	58	63	42	30
	1.0	40	37	75	81	38	68	56	40	63	65	49	33
	2.0	44	44	83	83	41	75	63	41	76	70	54	37
	3.0	35	39	46	64	36	59	52	36	58	53	43	34
	4.0	51	53	84	91	51	82	72	55	87	71	63	41
	5.0	47	44	79	84	46	72	60	48	69	63	55	41
	6.0	49	42	80	83	45	72		51	65	61	52	41
160	0.3	24	23	44	44	26	40	30	23	39	45	30	22
180	0.3	23	18	57	61	33	52	43	29	51	54	34	19
190	0.3	17	10	53	56	27	45	34	23	46	48	32	21



Table 16

## Downwash Velocities, CH-54 Lift-Off Tests

Helicopter Gross Weight, 29,400 and 39,800 lb; Disc Load, 7.22  
and 9.78 psf; Rotor Height Above Ground, 22 ft

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Gross Aircraft Weights, lb, Disc Loads, psf, and Headings, deg*											
		29,400 lb; 7.22 psf											
		0 deg	30 deg	60 deg	90 deg	120 deg	150 deg	180 deg	210 deg	240 deg	270 deg	300 deg	330 deg
20	0.3	39	44	41	46	16	46	54	50	44	41	41	46
30	0.3	54	53	61	47	55	53	51	55	53	52	53	48
	1.0	45	52	46	61	57	52	52	53	54	43	54	53
	2.0	53	56	55	55	60	60	59	61	63	58	62	59
	3.0	49	47	49	49	51	57	59	57	59	55	54	51
	4.0	37	39	34	34	36	47	53	43	43	42	39	36
	5.0	39	37	32	33	34	49	55	40	40	43	42	32
	6.0	28	35	21	25	31	45	49	27	33	37	42	23
40	0.3	29	48	44	33	49	46	48	45	51	49	46	45
50	0.3	77	61	63	74	61	65	64	60	72	109	63	62
	1.0	53	57	64	59	59	57	59	59	70	59	57	61
	2.0	45	39	49	50	49	53	51	53	60	55	47	53
	3.0	41	32	39	42	43	48	50	48	50	46	50	46
	4.0	35	26	26	30	28	35	48	34	39	32	47	39
	5.0	32	25	19	24	20	28	52	24	31	28	45	33
	6.0	23	18	11	29	32	20	38	14	18	21	37	21
60	0.3	40	34	38	46	36	42	47	37	47	48	43	40
70	0.3	38	38	37	41	25	35	40	37	46	44	41	41
	1.0	34	34	43	50	47	39	46	40	50	54	47	39
	2.0	26	26	31	30	35	30	35	30	39	36	36	31
	3.0	23	30	31	29	29	34	43	29	39	39	41	34
	4.0	23	25	28	22	18	25	37	21	31	28	30	27
	5.0	25	21	18	23	19	27	40	20	24	23	29	26
	6.0	27	19	16	15	19	27	39	11	19	21	23	27
80	0.3	26	26	35	36	25	26	30	26	31	39	32	32
90	0.3	22	34	35	39	32	31	37	32	34	35	34	35
	1.0	35	43	41	46	37	39	46	46	42	44	46	42
	2.0	35	38	40	43	34	37	43	41	45	39	36	37
	3.0	38	37	39	37	29	35	43	39	43	35	36	39
	4.0	41	41	47	43	39	42	49	44	47	45	44	45
	5.0	27	22	30	25	16	22	33	24	29	30	30	20
	6.0	41	29	39	35	26	33	45	32	30	32	43	40
100	0.3	25	32	30	36	26	30	37	32	36	31	33	36
110	0.3	23	34	29	28	19	29	28	27	26	26	27	30
	1.0	25	34	35	37	30	36	32	32	38	33	36	38
	2.0	27	38	35	40	31	37	36	35	35	36	38	42
	3.0	26	31	35	39	31	34	33	32	35	37	38	43
	4.0	18	24	29	31	26	24	32	20	25	28	31	31
	5.0	22	28	32	35	30	29	38	29	27	30	35	36
	6.0	11	20	27	29	16	22	34	22	18	25	29	29
120	0.3	14	19	22	24	7	23	25	20	23	20	21	26
130	0.3	20	25	27	28	20	22	26	27	28	24	23	29
140	0.3	18	19	21	25	16	17	22	17	22	18	20	21
150	0.3	16	12	16	22	8	16	18	12	20	13	16	20
	1.0	15	11	20	23	10	16	21	14	19	10	19	19
	2.0	16	12	23	31	11	14	24	16	21	13	21	20
	3.0	21	20	24	34	21	21	28	24	25	22	30	28
	4.0	23	24	24	30	19	20	23	18	22	21	28	24
	5.0	23	24	26	30	17	22	21	17	22	24	30	29
	6.0	17	16	19	26	15	17	16	9	16	22	25	21
160	0.3	15	15	21	24	14	20	23	13	21	15	22	22
170	0.3	10	12	13	18	9	14	13	8	13	10	18	13
180	0.3	16	19	21	27	17	21	25	16	21	20	31	20
190	0.3	6	9	11	16	12	10	15	6	9	10	19	8

(Continued)

\* Heading of helicopter nose relative to line of measurement points. Helicopter at heading of zero degrees faces all measurement points.

Table 16 (Concluded)

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Gross Aircraft Weights, lb, Disc Loads, psf, and Headings, deg											
		39,800 lb; 9.78 psf											
		0 deg	30 deg	60 deg	90 deg	120 deg	150 deg	180 deg	210 deg	240 deg	270 deg	300 deg	330 deg
20	0.3	32	48	50	54	40	53	58	50	51	28	36	48
30	0.3	55	61	62	65	65	57	58	65	60	51	53	65
	1.0	46	64	71	66	64	59	76	61	62	51	50	65
	2.0	58	64	71	66	67	68	71	66	73	63	60	67
	3.0	57	66	64	63	59	64	67	63	70	60	59	62
	4.0	46	50	50	44	43	50	58	50	56	53	52	48
	5.0	52	46	45	40	39	55	58	40	55	55	57	49
	6.0	52	38	28	30	49	54	58	43	44	55	58	39
40	0.3	54	61	52	52	53	55	53	55	57	57	51	50
50	0.3	80	88	75	79	67	82	78	60	76	84	83	79
	1.0	73	74	73	71	70	75	74	77	74	77	71	75
	2.0	50	62	62	58	57	66	64	64	62	68	58	63
	3.0	58	56	54	51	52	62	60	64	58	65	63	58
	4.0	51	43	45	44	44	56	56	50	56	50	61	43
	5.0	46	24	36	43	43	52	58	42	46	49	64	42
	6.0	34	17	23	25	--	35	41	28	32	46	52	24
60	0.3	53	55	51	42	47	45	49	50	59	59	61	55
70	0.3	50	52	50	52	48	50	54	44	52	61	49	50
	1.0	54	60	56	55	52	51	55	47	56	62	47	56
	2.0	40	44	44	43	36	43	45	34	46	49	40	44
	3.0	43	49	52	49	41	39	47	47	50	56	45	47
	4.0	37	39	44	39	--	39	45	42	40	47	40	35
	5.0	32	32	36	38	37	38	49	42	44	48	36	35
	6.0	23	26	23	36	32	31	--	34	42	44	38	31
80	0.3	37	42	40	39	39	34	39	34	42	44	41	36
90	0.3	42	45	47	43	44	39	48	38	49	51	42	44
	1.0	50	59	54	54	52	45	58	48	62	62	48	57
	2.0	48	51	53	50	48	43	57	48	55	60	45	55
	3.0	46	45	50	48	45	45	53	46	51	53	48	52
	4.0	51	51	58	57	50	53	58	53	55	56	55	51
	5.0	32	33	38	36	37	32	43	33	32	42	35	29
	6.0	43	38	48	52	48	41	58	38	47	54	45	40
100	0.3	37	40	42	44	41	35	42	35	41	46	37	40
110	0.3	34	37	39	39	37	31	34	30	39	44	34	37
	1.0	45	46	47	48	49	37	47	37	48	55	43	47
	2.0	47	46	44	52	50	42	56	42	51	54	45	60
	3.0	42	43	49	49	48	40	54	41	48	50	44	53
	4.0	35	27	45	40	41	36	52	36	40	44	32	46
	5.0	36	41	47	41	42	38	55	40	41	46	36	45
	6.0	28	32	40	30	31	27	47	29	31	37	28	32
120	0.3	35	30	36	42	33	27	35	23	37	38	30	37
130	0.3	35	31	37	40	35	28	35	28	35	39	31	38
140	0.3	29	26	33	32	26	26	29	26	30	34	28	32
150	0.3	24	19	25	28	20	21	26	22	26	31	28	27
	1.0	29	23	26	31	25	24	31	22	30	35	28	28
	2.0	30	32	27	36	29	23	36	25	31	36	23	31
	3.0	34	36	34	36	34	30	40	30	37	39	26	32
	4.0	30	31	33	36	35	29	38	30	37	40	24	34
	5.0	27	28	32	37	35	30	42	31	41	40	25	32
	6.0	22	24	25	33	32	27	35	25	35	29	21	26
160	0.3	25	24	28	32	23	22	34	21	30	29	26	28
170	0.3	18	16	20	24	15	16	28	14	25	22	20	18
180	0.3	28	26	31	33	24	26	37	21	37	29	24	29
190	0.3	12	15	20	21	13	15	24	10	22	16	12	20

Table 17

## Downwash Velocities, CH-54 Hover Tests 40 ft Above Ground

Helicopter Gross Weight, 28,600, 38,000, and 47,000 lb; Disc Load, 7.02, 9.33, and 11.55 psf; Rotor Height Above Ground, 40 ft

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Gross Aircraft Weights, lb, Disc Loads, psf, and Headings, deg*											
		28,600 lb; 7.02 psf											
		0 deg	30 deg	60 deg	90 deg	120 deg	150 deg	180 deg	210 deg	240 deg	270 deg	300 deg	330 deg
20	0.3	--	36	39	46	43	43	41	43	35	23	25	47
30	0.3	30	43	48	49	46	46	46	52	50	43	43	52
	1.0	29	40	48	50	49	51	48	53	48	43	36	50
	2.0	36	43	57	56	52	57	57	55	57	50	48	54
	3.0	29	40	51	49	47	55	53	48	55	47	45	49
	4.0	21	27	38	36	36	42	40	41	43	38	36	36
	5.0	27	29	35	37	37	46	43	46	46	43	40	36
	6.0	25	35	41	27	33	49	42	44	40	43	46	30
40	0.3	42	40	42	42	42	46	48	47	53	44	40	42
50	0.3	61	57	57	64	58	62	69	72	72	67	73	63
	1.0	54	51	62	55	57	64	60	60	67	60	62	55
	2.0	45	38	50	49	49	54	51	49	58	49	53	51
	3.0	46	36	47	49	41	50	48	45	54	48	47	44
	4.0	46	32	26	38	31	40	36	38	45	44	42	36
	5.0	39	30	23	35	28	41	28	27	36	40	43	30
	6.0	32	24	21	27	19	32	21	22	21	21	37	22
60	0.3	45	32	41	46	34	41	43	49	57	43	45	42
70	0.3	40	30	42	34	34	38	39	43	44	41	42	38
	1.0	46	27	45	46	35	44	41	44	58	47	46	44
	2.0	32	19	31	32	26	34	29	26	46	35	32	32
	3.0	33	23	35	30	27	41	29	30	44	42	39	36
	4.0	26	22	30	26	22	34	31	28	39	33	37	28
	5.0	22	25	28	25	20	31	18	27	33	29	41	27
	6.0	16	23	23	19	16	25	19	22	23	22	38	21
80	0.3	35	18	34	35	26	32	25	32	34	34	32	31
90	0.3	35	24	38	38	30	39	29	30	47	37	31	35
	1.0	45	29	50	42	36	46	40	42	53	45	41	50
	2.0	43	25	43	40	36	45	38	39	48	42	36	43
	3.0	37	25	37	36	38	46	35	36	42	37	34	36
	4.0	37	36	43	38	47	53	40	39	52	49	38	40
	5.0	19	20	22	14	29	30	27	25	33	28	24	26
	6.0	30	30	30	21	42	38	38	33	45	36	40	38
100	0.3	33	25	37	36	32	35	25	31	35	37	36	33
110	0.3	26	19	30	29	21	33	27	24	36	33	25	28
	1.0	31	21	40	32	29	38	36	29	41	41	32	38
	2.0	39	27	40	36	36	43	37	35	44	44	34	39
	3.0	38	26	37	34	37	44	37	36	41	42	34	39
	4.0	28	17	24	26	30	36	29	26	37	34	25	32
	5.0	29	24	27	25	34	40	31	30	38	37	32	36
	6.0	18	17	16	15	31	32	23	18	33	30	26	31
120	0.3	20	7	26	19	17	28	23	15	29	26	22	22
130	0.3	24	18	30	24	24	31	23	21	26	26	26	26
140	0.3	18	11	27	22	13	23	19	14	22	21	19	25
150	0.3	12	6	24	23	9	22	14	13	20	14	17	19
	1.0	14	6	27	20	10	22	13	14	21	16	19	22
	2.0	20	7	29	31	10	25	19	14	21	19	18	19
	3.0	28	16	32	34	20	31	25	21	28	26	25	27
	4.0	28	16	31	24	19	32	20	20	28	26	24	29
	5.0	29	18	30	25	21	36	22	22	32	28	28	33
	6.0	22	14	26	29	16	32	17	16	25	22	24	27
160	0.3	18	12	28	21	14	25	18	18	27	18	18	24
170	0.3	14	5	19	14	9	16	10	12	17	12	11	18
180	0.3	21	14	29	18	12	24	18	19	25	17	22	24
190	0.3	8	3	22	12	2	12	5	10	12	5	14	12

(Continued)

\* Heading of helicopter nose relative to line of measurement points. Helicopter at heading of zero degrees faces all measurement points.

Table 17 (Continued)

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Gross Aircraft Weights, lb, Disc Loads, psf, and Headings, deg												
		38,000 lb; 9.33 psf												
		0	30	60	90	120	150	180	210	240	270	300	330	
		deg	deg	deg	deg	deg	deg	deg	deg	deg	deg	deg	deg	deg
20	0.3	6	33	52	55	55	45	43	51	47	41	20	15	
30	0.3	34	55	63	61	56	51	56	61	61	48	41	48	
	1.0	33	49	56	62	56	42	56	64	58	48	41	46	
	2.0	47	60	66	68	62	56	64	68	66	56	43	52	
	3.0	43	58	62	62	56	57	60	60	65	55	41	53	
	4.0	33	48	47	47	42	45	47	47	56	47	37	42	
	5.0	38	48	49	44	41	50	50	43	58	54	48	47	
	6.0	38	45	41	35	28	54	47	41	54	52	40	45	
40	0.3	67	60	52	54	51	53	54	51	58	50	43	52	
50	0.3	83	80	79	95	74	67	74	72	86	82	77	79	
	1.0	67	75	76	76	66	72	71	71	78	68	63	72	
	2.0	62	62	63	63	52	58	59	60	69	54	56	63	
	3.0	58	59	59	57	50	58	53	55	63	54	51	61	
	4.0	49	46	53	47	38	58	45	49	52	50	48	49	
	5.0	55	42	48	45	29	60	38	46	46	49	48	51	
	6.0	32	31	30	27	23	54	34	38	41	46	42	39	
60	0.3	60	56	56	57	50	56	55	52	61	56	56	62	
70	0.3	51	52	58	51	46	51	50	47	59	51	50	51	
	1.0	61	55	65	58	49	54	57	55	65	60	62	53	
	2.0	40	43	46	45	39	46	39	36	50	41	43	48	
	3.0	44	44	51	46	51	53	43	39	59	44	43	54	
	4.0	29	37	38	43	32	49	39	32	51	41	42	48	
	5.0	29	34	35	44	30	52	40	34	52	43	45	45	
	6.0	17	25	30	36	27	50	32	21	43	42	46	36	
80	0.3	44	42	40	44	35	44	40	35	51	43	41	43	
90	0.3	47	46	49	52	41	49	41	38	58	44	51	47	
	1.0	62	56	60	64	50	57	47	54	72	57	62	60	
	2.0	55	50	57	61	49	59	49	49	72	60	55	59	
	3.0	53	50	55	55	45	58	52	41	64	54	48	53	
	4.0	53	53	55	62	49	63	58	47	64	57	54	59	
	5.0	29	35	33	41	32	45	35	28	41	38	43	37	
	6.0	38	47	43	53	35	58	44	37	52	54	60	46	
100	0.3	45	47	44	46	34	46	36	34	49	41	46	49	
110	0.3	38	37	40	43	25	43	31	25	43	37	38	45	
	1.0	44	46	52	51	33	56	37	35	48	44	48	52	
	2.0	46	58	50	55	43	60	39	40	60	44	52	49	
	3.0	45	54	45	51	40	60	40	40	54	44	48	45	
	4.0	37	46	39	42	40	52	35	34	46	40	42	41	
	5.0	38	46	41	44	40	53	35	37	46	44	44	47	
	6.0	27	37	34	34	33	45	25	28	38	37	37	40	
120	0.3	32	40	41	46	31	46	31	18	45	26	34	38	
130	0.3	34	38	38	34	34	43	31	27	39	28	35	36	
140	0.3	27	34	36	31	26	41	24	10	24	19	23	25	
150	0.3	25	30	32	27	20	34	18	13	30	26	24	30	
	1.0	27	34	34	32	22	39	20	15	33	30	26	29	
	2.0	30	39	41	37	25	46	26	23	36	35	28	31	
	3.0	35	43	42	39	32	48	32	29	36	38	32	33	
	4.0	34	39	41	39	30	48	32	28	38	37	31	36	
	5.0	35	36	35	42	25	52	31	26	37	37	31	35	
	6.0	26	30	32	35	18	46	24	22	35	28	26	29	
160	0.3	29	21	32	28	20	32	23	15	36	27	26	29	
170	0.3	19	15	20	18	16	27	15	11	26	24	18	22	
180	0.3	27	24	34	29	26	34	26	14	35	33	27	30	
190	0.3	14	12	20	20	12	21	15	8	27	20	14	19	

Table 17 (Concluded)

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Gross Aircraft Weights, lb, Disc Loads, psf, and Headings, deg 47,000 lb; 11.55 psf											
		0	30	60	90	120	150	180	210	240	270	300	330
		deg	deg	deg	deg	deg	deg	deg	deg	deg	deg	deg	deg
20	0.3	30	46	48	66	57	60	55	68	38	54	41	23
30	0.3	48	62	74	62	68	66	56	68	54	67	62	45
	1.0	46	59	62	70	60	59	60	61	55	64	60	49
	2.0	51	70	70	74	67	60	64	72	64	72	66	57
	3.0	46	60	64	60	58	53	59	66	60	67	64	62
	4.0	34	44	51	47	38	38	45	47	53	54	51	51
	5.0	39	40	49	39	30	42	49	47	59	59	55	45
	6.0	41	45	42	22	22	32	44	42	51	52	42	42
40	0.3	47	54	56	52	51	49	48	51	53	58	58	49
50	0.3	70	83	87	61	62	73	70	71	87	79	84	76
	1.0	58	73	79	66	59	67	63	72	76	71	75	60
	2.0	52	58	61	58	50	53	54	57	62	59	65	54
	3.0	51	52	59	58	51	49	53	53	58	57	60	49
	4.0	47	41	41	44	40	42	48	50	50	5	48	47
	5.0	45	39	33	34	33	35	45	45	44	53	45	48
	6.0	33	28	18	20	23	31	30	31	34	41	34	37
60	0.3	51	48	56	49	40	54	48	58	56	50	57	46
70	0.3	49	42	47	49	43	49	49	53	54	50	51	43
	1.0	51	49	49	49	46	53	54	65	56	59	61	49
	2.0	37	38	36	43	32	39	39	43	40	42	44	37
	3.0	41	37	35	46	30	40	39	48	42	49	53	39
	4.0	34	25	29	37	26	34	32	37	35	42	47	33
	5.0	37	21	30	33	25	31	35	38	35	49	48	31
	6.0	38	25	26	30	20	28	35	35	27	45	40	28
80	0.3	42	41	40	40	36	40	40	42	40	41	41	34
90	0.3	36	49	46	39	40	42	54	42	42	44	52	40
	1.0	49	56	54	50	45	52	39	47	48	56	56	47
	2.0	47	53	50	49	42	52	39	51	52	53	50	43
	3.0	46	49	44	48	44	49	32	44	48	51	48	39
	4.0	52	51	43	51	49	50	35	54	52	57	59	46
	5.0	38	29	28	33	29	34	31	33	38	39	40	26
	6.0	42	39	38	45	40	44	42	43	44	51	57	34
100	0.3	31	43	41	43	38	38	49	48	35	39	47	30
110	0.3	5	20	35	29	25	32	47	38	35	39	42	32
	1.0	14	32	41	41	38	44	43	49	46	49	55	38
	2.0	22	35	41	46	39	48	43	53	50	56	51	41
	3.0	25	29	39	46	38	44	48	46	50	49	44	41
	4.0	23	19	32	39	29	37	31	41	39	41	41	33
	5.0	29	24	35	41	33	38	42	36	39	41	45	35
	6.0	26	16	31	37	25	30	40	30	30	31	38	25
120	0.3	16	25	33	21	22	20	34	23	41	33	34	28
130	0.3	--	8	25	23	--	12	32	24	41	31	40	32
140	0.3	--	--	--	2	--	8	28	2	29	20	35	23
150	0.3	--	--	--	--	--	--	7	--	13	9	30	14
	1.0	--	--	--	--	--	--	19	--	17	18	37	14
	2.0	--	--	--	--	--	--	29	--	21	20	41	14
	3.0	--	--	11	12	--	--	36	6	22	22	43	21
	4.0	--	--	13	11	--	--	42	4	21	22	41	22
	5.0	--	--	18	10	--	--	36	4	24	24	45	24
	6.0	--	--	15	8	--	--	36	4	18	21	34	22
160	0.3	--	--	--	--	--	--	4	--	14	6	22	18
170	0.3	--	--	--	--	--	--	--	--	--	--	2	11

Table 18

Downwash Velocities, CH-54 Hover Tests 80 ft Above Ground  
 Helicopter Gross Weight, 27,400, 38,000, and 45,000 lb; Disc Load, 6.73,  
 9.33, and 11.05 psf; Rotor Height Above Ground, 80 ft

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Gross Aircraft Weights, lb, Disc Loads, psf, and Headings, deg*											
		27,400 lb; 6.73 psf											
		0 deg	30 deg	60 deg	90 deg	120 deg	150 deg	180 deg	210 deg	240 deg	270 deg	300 deg	330 deg
20	0.3	39	44	44	44	41	34	31	41	19	33	20	36
30	0.3	46	39	43	47	43	37	40	45	43	44	35	48
	1.0	45	39	45	47	44	39	41	48	40	41	34	46
	2.0	48	45	48	52	48	50	48	52	49	48	42	54
	3.0	42	37	42	46	43	49	47	51	49	45	43	51
	4.0	31	31	30	33	31	38	38	41	38	36	32	38
	5.0	29	39	27	35	33	45	43	45	42	42	50	39
	6.0	28	26	23	30	28	43	42	45	37	37	36	32
40	0.3	46	33	37	43	41	43	42	43	46	44	39	40
50	0.3	72	49	60	72	62	63	70	65	74	66	60	64
	1.0	56	46	50	59	58	57	59	61	69	61	52	64
	2.0	45	37	39	51	47	53	45	53	33	50	45	54
	3.0	35	37	37	47	46	49	46	49	51	48	48	52
	4.0	24	36	30	41	40	41	43	46	43	39	43	42
	5.0	18	40	25	34	36	43	44	50	36	35	43	37
	6.0	13	34	19	18	27	36	38	40	25	28	31	27
60	0.3	41	33	38	45	42	42	43	45	47	47	39	45
70	0.3	38	32	36	41	43	46	40	43	47	45	37	41
	1.0	41	35	43	48	52	51	45	49	50	49	40	43
	2.0	28	25	29	36	34	33	32	35	39	32	30	35
	3.0	28	26	29	39	37	33	32	37	39	36	25	41
	4.0	21	24	25	31	32	28	25	31	30	31	28	35
	5.0	21	26	26	24	33	28	27	37	28	26	30	35
	6.0	16	27	22	17	30	27	24	38	27	21	27	32
80	0.3	27	26	28	31	32	41	32	36	36	35	29	22
90	0.3	41	25	29	35	32	32	32	39	34	40	34	30
	1.0	48	35	41	42	38	43	42	51	45	45	46	40
	2.0	40	34	36	42	41	43	39	48	40	37	40	34
	3.0	35	33	31	39	42	44	39	44	37	40	36	32
	4.0	37	40	35	39	51	49	44	48	41	45	33	42
	5.0	20	29	20	26	29	29	27	30	26	27	23	25
	6.0	28	36	31	36	40	34	40	43	38	36	37	34
100	0.3	36	25	33	33	30	31	31	35	28	40	34	31
110	0.3	28	24	27	26	24	29	26	33	23	31	26	27
	1.0	32	31	38	36	32	40	31	41	34	40	37	37
	2.0	39	35	42	35	35	46	33	39	34	40	41	39
	3.0	36	34	34	34	40	47	31	38	29	37	43	34
	4.0	27	23	22	25	34	40	22	28	17	27	36	24
	5.0	30	28	27	28	36	40	28	32	24	31	37	28
	6.0	18	16	18	26	31	28	21	25	20	16	30	19
120	0.3	26	23	25	20	20	29	19	28	19	29	22	20
130	0.3	29	25	26	26	29	28	21	31	23	35	26	28
140	0.3	26	16	21	22	22	20	18	27	19	21	19	22
150	0.3	18	7	17	18	15	15	15	20	15	17	13	17
	1.0	22	8	18	19	18	17	14	21	17	17	17	13
	2.0	26	8	21	19	19	22	19	27	19	16	15	20
	3.0	30	19	27	23	24	31	26	34	28	20	21	26
	4.0	27	13	25	19	23	28	24	31	24	18	20	27
	5.0	30	17	28	21	24	30	23	35	21	21	21	30
	6.0	23	13	22	15	24	22	16	30	17	16	18	24
160	0.3	17	11	23	21	17	20	20	20	18	18	19	21
170	0.3	9	9	15	15	12	13	10	12	12	12	12	14
180	0.3	17	17	24	19	20	20	19	20	21	17	20	23
190	0.3	6	6	12	11	8	10	8	6	10	8	6	11

(Continued)

\* Heading of helicopter nose relative to line of measurement points. Helicopter at heading of zero degrees faces all measurement points.

Table 18 (Continued)

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Gross Aircraft Weights, lb, Disc Loads, psf, and Headings, deg											
		38,000 lb; 9.33 psf											
		0 deg	30 deg	60 deg	90 deg	120 deg	150 deg	180 deg	210 deg	240 deg	270 deg	300 deg	330 deg
20	0.3	15	24	53	56	51	46	37	43	16	40	34	11
30	0.3	37	48	66	59	53	49	45	55	38	49	43	38
	1.0	35	44	57	60	53	51	46	59	40	48	41	37
	2.0	48	53	66	61	64	62	54	64	48	55	49	45
	3.0	41	52	61	58	60	63	55	55	52	56	46	45
	4.0	34	44	42	40	46	50	47	47	42	51	41	34
	5.0	40	45	41	42	46	53	51	46	47	53	46	40
	6.0	42	41	32	34	48	50	50	46	48	50	43	42
40	0.3	46	53	57	50	49	44	48	52	48	47	51	47
50	0.3	83	82	75	76	68	70	78	71	83	81	79	88
	1.0	68	72	67	70	68	64	69	71	72	74	67	66
	2.0	57	61	61	57	58	58	63	61	61	62	58	60
	3.0	50	56	58	57	54	58	59	52	56	62	58	60
	4.0	48	50	46	48	45	50	51	42	46	54	53	53
	5.0	54	47	39	40	46	50	51	40	48	58	54	52
	6.0	42	34	28	29	35	42	42	38	39	48	38	38
60	0.3	59	52	51	51	47	52	53	53	65	63	54	50
70	0.3	55	48	51	50	43	48	44	49	51	57	51	50
	1.0	68	60	56	54	51	54	52	52	57	66	54	55
	2.0	48	42	44	40	35	42	38	40	43	46	38	45
	3.0	52	43	47	43	41	49	45	49	48	53	41	46
	4.0	42	38	38	34	34	45	46	45	38	43	37	41
	5.0	40	41	32	35	38	46	42	44	38	42	39	34
	6.0	36	38	22	32	33	44	36	43	34	34	34	27
80	0.3	50	42	40	40	32	40	41	40	45	51	42	39
90	0.3	55	46	47	44	50	45	47	46	56	54	48	44
	1.0	67	54	56	56	58	55	57	52	69	63	55	54
	2.0	60	52	53	52	56	55	58	51	59	59	54	53
	3.0	51	49	48	49	48	52	51	51	53	52	54	44
	4.0	57	50	52	57	53	60	55	58	53	57	56	51
	5.0	42	35	30	36	36	43	39	41	32	41	35	36
	6.0	48	43	36	51	45	54	49	45	43	55	48	49
100	0.3	47	39	45	46	43	49	44	41	48	53	42	38
110	0.3	44	36	39	41	36	47	42	34	47	46	39	35
	1.0	52	40	50	50	45	56	44	44	55	55	51	47
	2.0	51	40	51	52	50	57	52	47	60	55	52	47
	3.0	46	42	51	49	47	54	50	48	51	51	53	45
	4.0	38	37	42	39	40	47	41	39	48	44	47	42
	5.0	40	42	43	40	40	48	43	41	43	48	44	42
	6.0	38	34	35	31	34	42	36	35	43	42	34	33
120	0.3	39	27	38	38	32	48	39	32	43	38	38	34
130	0.3	39	29	43	40	35	45	36	34	34	42	37	34
140	0.3	25	18	32	31	21	33	25	1	29	31	26	25
150	0.3	25	20	37	33	24	32	25	24	32	30	26	26
	1.0	27	24	20	37	27	36	31	24	36	31	30	30
	2.0	32	27	40	34	32	39	36	26	36	36	36	28
	3.0	36	32	37	33	38	41	40	22	37	38	39	30
	4.0	33	32	33	28	39	38	41	34	36	41	41	29
	5.0	34	34	33	29	42	42	44	36	36	43	43	30
	6.0	26	24	27	22	33	33	34	31	30	33	37	26
160	0.3	27	23	15	32	34	32	30	25	30	31	30	29
170	0.3	19	16	23	21	21	24	20	18	21	25	25	20
180	0.3	29	26	36	27	28	32	30	27	31	38	28	26
190	0.3	20	16	22	14	18	21	19	18	21	28	18	16

Table 18 (Concluded)

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Gross Aircraft Weights, lb, Disc Loads, psf, and Headings, deg											
		45,000 lb; 11.05 psf											
		0 deg	30 deg	60 deg	90 deg	120 deg	150 deg	180 deg	210 deg	240 deg	270 deg	300 deg	330 deg
20	0.3	9	26	57	56	58	55	58	--	58	64	58	43
30	0.3	37	43	54	54	50	52	55	--	51	61	57	49
	1.0	36	38	56	50	54	58	58	--	54	65	58	48
	2.0	40	45	59	57	60	54	56	--	57	66	53	49
	3.0	36	44	52	51	54	46	60	--	46	58	49	51
	4.0	26	36	33	33	37	35	49	--	28	37	34	38
	5.0	34	43	25	30	36	34	48	--	29	37	34	39
	6.0	31	47	20	21	26	32	43	--	16	28	32	36
40	0.3	44	47	46	42	46	49	45	--	42	51	52	44
50	0.3	66	66	62	62	63	62	64	--	50	68	74	72
	1.0	55	50	60	55	56	61	63	--	54	62	62	60
	2.0	49	46	48	45	48	50	52	--	47	51	46	50
	3.0	52	49	38	45	50	46	55	--	43	51	39	49
	4.0	48	47	33	38	36	36	46	--	36	47	27	34
	5.0	44	50	29	29	31	32	42	--	32	44	22	32
	6.0	36	43	22	21	22	27	36	--	20	27	15	25
60	0.3	51	50	41	42	41	40	43	--	43	50	51	47
70	0.3	48	45	37	42	34	41	40	--	44	47	30	37
	1.0	49	53	41	44	41	43	46	--	46	52	42	36
	2.0	35	35	30	30	29	34	34	--	32	36	32	32
	3.0	37	40	30	30	31	31	39	--	30	39	33	33
	4.0	33	37	27	29	27	24	36	--	26	32	26	25
	5.0	33	40	29	29	28	20	28	--	29	33	27	23
	6.0	27	40	25	23	28	25	28	--	27	27	23	23
80	0.3	36	36	27	33	29	33	31	--	33	40	31	27
90	0.3	41	41	18	37	35	33	39	--	34	45	33	30
	1.0	52	48	38	45	44	43	45	--	40	66	44	39
	2.0	42	41	37	43	43	38	45	--	37	50	40	37
	3.0	38	41	38	42	43	38	49	--	39	44	40	36
	4.0	41	48	43	49	49	42	57	--	45	50	47	43
	5.0	26	34	27	31	32	21	38	--	26	33	26	24
	6.0	31	51	37	39	42	30	46	--	35	44	37	33
100	0.3	42	41	6	36	35	31	36	--	28	39	24	30
110	0.3	42	34	--	26	25	22	22	--	18	30	--	26
	1.0	52	44	6	39	39	33	37	--	27	38	13	38
	2.0	51	46	11	42	42	35	42	--	30	40	15	34
	3.0	44	41	15	40	40	32	45	--	27	41	15	33
	4.0	35	37	12	32	35	23	42	--	18	34	15	26
	5.0	37	37	20	35	35	24	46	--	25	38	25	27
	6.0	30	34	11	28	25	18	42	--	15	30	21	18
120	0.3	32	28	--	22	3	--	15	--	--	--	--	7
130	0.3	26	30	--	9	6	--	--	--	--	--	--	9
140	0.3	12	15	--	--	--	--	--	--	--	--	--	--
150	0.3	9	9	--	--	--	--	--	--	--	--	--	--
	1.0	14	14	--	--	--	--	--	--	--	--	--	--
	2.0	12	13	--	--	--	--	--	--	--	--	--	--
	3.0	12	12	--	--	--	--	--	--	--	--	--	--



Table 19

## Downwash Velocities, CH-54 Fly-By Tests

Helicopter Gross Weight, 27,400, 38,000, and 45,000 lb; Disc Load, 6.73, 9.33, and 11.05 psf; Rotor Height Above Ground, 28 ft

Horizontal Distance from Rotor Hub(s), ft	Velocity Point Height Above Ground, ft	Downwash Velocities, mph, at Indicated Gross Aircraft Weights, lb, Disc Loads, psf, and Headings, deg*					
		27,400 lb; 6.73 psf		38,000 lb; 9.33 psf		45,000 lb; 11.05 psf	
		90 deg	270 deg	90 deg	270 deg	90 deg	270 deg
20	0.3	46	37	23	39	34	41
30	0.3	45	42	50	55	60	48
	1.0	50	43	47	55	65	51
	2.0	54	50	54	58	67	60
	3.0	49	48	54	56	52	58
	4.0	37	39	42	45	31	43
	5.0	37	43	45	48	28	48
	6.0	32	40	45	45	57	47
40	0.3	42	42	50	52	50	51
50	0.3	58	54	79	76	74	71
	1.0	57	52	72	72	64	69
	2.0	47	48	61	61	58	60
	3.0	45	49	60	56	56	58
	4.0	40	44	51	50	43	48
	5.0	35	42	45	42	32	45
	6.0	26	35	37	29	22	40
60	0.3	43	41	57	59	43	53
70	0.3	43	39	52	51	46	47
	1.0	44	45	62	52	44	52
	2.0	32	32	46	35	33	37
	3.0	37	34	50	40	38	49
	4.0	33	26	42	32	34	44
	5.0	30	25	38	32	35	38
	6.0	23	25	27	29	36	31
80	0.3	35	30	40	37	33	--
90	0.3	33	28	45	38	42	43
	1.0	43	37	56	51	50	53
	2.0	41	36	52	46	43	52
	3.0	40	36	49	43	39	55
	4.0	44	43	52	48	44	60
	5.0	33	30	32	31	29	39
	6.0	44	39	46	44	46	41
100	0.3	33	30	43	38	35	41
110	0.3	31	31	38	32	31	39
	1.0	39	40	49	39	37	54
	2.0	41	46	52	40	37	59
	3.0	39	45	51	42	36	53
	4.0	30	36	45	34	30	43
	5.0	34	35	43	38	34	43
	6.0	31	31	35	31	27	37
120	0.3	27	27	43	29	19	35
130	0.3	30	30	38	29	24	34
140	0.3	25	24	25	22	14	29
150	0.3	22	16	30	21	--	24
	1.0	23	17	33	30	--	25
	2.0	26	22	36	30	--	27
	3.0	30	31	38	32	14	33
	4.0	28	30	38	30	12	32
	5.0	30	30	42	30	14	37
	6.0	22	21	34	22	11	31
160	0.3	26	12	35	23	--	26
170	0.3	18	9	25	14	--	15
180	0.3	24	17	32	25	--	19
190	0.3	16	7	21	12	--	--

\* Heading of helicopter nose relative to line of measurement points. Helicopter at heading of zero degrees faces all measurement points.